THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ILLUSION OF THE MINIMUM WAGE.

Now that the Government are committed to the principle of a minimum wage in connection with one of the most important industries of this country, it is not without the bounds of probability that attempts will be made to extend it in other directions. Appetite in these matters grows with eating; and if the Proletariat are given an inch, they have a well-known propensity for taking an ell.

One cause will operate to induce those who belong to other Trade Unions to persuade the Government to decree a minimum for the benefit of their members. The success of nearly every undertaking depends upon the supply of cheap coal. Dear coal means increased cost of production, and increased cost of living. It will, therefore, involve a demand for higher wages; and sooner or later the tidal wave recently set in motion will reach that great section of the community which makes its living by the supply of electricity and the manufacture of electrical machinery. In these circumstances it is not unprofitable to examine the views of some of the older economists on this question of the minimum wage.

There are some people who are sufficiently dense to refuse to believe that a universal rise in wages leaves the community no richer than it was before. A simple illustration must be our first and last effort to reason with such as these. An artisan from one of our Colonies was boasting that the minimum legal wage in his industry was 8s. a day. He was pitying the lot of an English comrade who could earn but 3s. 6d. at the same trade. The following dialogue was then heard:—"What do you pay for your cottage in New Zealand?" "15s. a week," was the reply. Upon which the Englishman remarked, "I can get all the house I want for 5s. What do you pay for boots?" "Oh, I can get a decent pair for 30s." When the Englishman realised that he could get a pair of boots for 10s., he began to think that the New Zealander's 8s. a day left him not much better off than those who lived on a pittance in the old country.

No less an authority than John Stuart Mill, writing so long ago as 1867, discussed the theory of minimum wage. He said: "A plan which has found many advocates among the leaders of the operatives is that councils should be formed, which in England have been called local boards of trade, in France '*conseils de prud' hommes*,' and other names, consisting of delegates from the workpeople and from the employers, who, meeting in conference, should agree upon a rate of wages and promulgate it from authority, to be binding generally on employers and workmen; the ground of decision being, not the state of the labour market, but natural equity; to provide that the workmen shall have *reasonable* wages, and the capitalists reasonable profits."

One might almost suppose that Mr. Asquith had the work

which contains this passage before him when he framed his first proposals for the settlement of the Coal Strike, which have since been embodied in the Coal Mines Bill, but he omitted the element of compulsion so far as the workmen were concerned. If he was, in fact, guided by this principle, it is a pity that he did not read on, in order to understand the views of the greatest political economist of the last century upon the proposal which it embodies. Mr. Mill points out that the rate of wages which results from competition distributes the whole wages fund amongst the whole labouring population; and that if law or opinion succeeds in fixing wages above this rate, some labourers must necessarily be kept out of employment. As it is not the intention of the philanthropists that these should starve, they must be provided for by a forced increase of the wages fund; by a compulsory saving. "It is nothing," writes Mr. Mill in memorable words, "to fix a minimum wage, unless there be a provision that work, or wages at least, be found for all who apply for it." He goes on to say that if the moral influence of opinion does not induce the rich to spare from their consumption enough to set all the poor to work at "reasonable wages," it is supposed to be incumbent on the State to lay on taxes for the purpose, either by local rates or votes of public money.

Into the objections which he advances to the principle of the minimum wage, we need not follow Mr. Mill further than to say this: He points out that it involves the imposition of a burden on the community, which can only be borne by increased taxation. In effect it tends to encourage the belief that everyone has a right to be supported by the State. It would not be "to each according to his sacrifice," but "to each according to his need."

It will be said, of course, that much has happened since Mill voiced his objection to the minimum wage; but it is material to notice that he objected to it even if the element of compulsion could operate against men as well as masters. Although, under the Bill discussed in Parliament this week, there is no compulsion in law, it is manifest that there will be compulsion on the employers in fact. An agreement to work for less than minimum wage is to be void; but the men are not to be compelled to produce at least a minimum quantity for the minimum wage.

Industries like that with which this journal is primarily concerned may not appear to be closely affected by the establishment of a minimum wage for miners; but it is the admission of the principle which is so dangerous, and those who control the electrical world will be justified in taking any steps which may be necessary to prevent the spread of any movement in the direction of a national strike.

THE FRUITS OF THE COAL STRIKE.

Writing at a time when the strike is still unsettled, the framing of any prophecy must be dangerous for the reason that we cannot foretell all the outcomes, and in peering through the mists of conflict, we cannot see all the indications of reef or shoal which in clearer times warn us to steer in safe courses. The immediate prospects are bad enough in all conscience, but matters of immediate menace are better whispered of in the council chamber than bawled amid the throng of the idle market place, where the frenzied pestilences of panic may take birth.

Matters of political opportunism, sometimes misnamed statecraft, are of necessity precluded from the columns of a technical journal. In them, however, we can discuss immediate and remote problems which will confront us when the strike is settled. The condition of the electrical manufacturer will be an anxious one. Himself both participant in and sufferer through the cut-throat policy of putting in low tenders in times of poor demand and bad trade, the present year had, save for the labour cloud, opened smoothly. It is scarcely an exagration to say that, in commercial tendering, the competition had become rather a matter of delivery than of price. Large outputs had made his works load factor satisfactory, and raised hopes in many cases of satisfactory dividends. Activity had brought with it certain troubles of its own. Porcelain, copper, and iron castings were hard to get—in some cases even work had not been started on contracts until the expiration of the contract date, for lack of raw material to feed the machines. Then again, there had been competition for suitable labour, for in some areas local supplies had been exhausted. Such evils of good trade were, however, endurable, although it was irksome to feel that the pestilential "ca' canny" policy was often preventing his men from working "all out" and making hay while the sun of good trade was shining.

As a whole, the engineering industries of this country have not been so full of work since the boom of 1873, and we have to realise the sorrowful fact that the coal strike has abruptly arrested this, and that it is doubtful whether we can pick up our stride again. At the best, some months must elapse after the nominal ending of the strike before manufacturing conditions become normal in regard to securing raw material. Raw material in hand will be exhausted by those firms who are still able to raise steam from their reserves of coal, or can obtain power from power stations. To obtain more castings or forgings will mean waiting until the iron and steel industries get under way and proceed to distribute their output among those keenly competing for it. The electrical manufacturers of this country will, therefore, be well deserving of all the latitude that can possibly be extended to them by their customers.

Another of the effects of the strike will be that of the greatest incentive to economy and efficiency that can be conceived. For one thing, it will have done more to promote thermal efficiency and fuel conservation than either the Report of the last Royal Commission on the duration of our coal fields or many lectures on thermodynamics. Fuel conservation must imply not only plant thermally efficient, but the economical utilisation of the power produced by the securing of the best load factor. The colossally extravagant domestic grate must be restricted in its use and give place to electricity and gas for domestic cooking and heating.

Bulk supply and sub-station distribution must replace many of the small lighting and power stations with bad load factors. No strike was ever designed to reduce the cost of production of the commodity concerned, so that both the position of the internal-combustion engine will be strengthened, and in the getting and handling of coal labour-saving machinery must to an increasing degree tend to reduce the amount of labour required. We commend this to the consideration of those responsible for the present situation.

Moreover, idle vehicle mileage—which is only another name for the bad load factor of an idle ton-mileage—must be largely restricted for the future. The travelling public will have to journey in better loaded trains with less elbow room, and fewer tramcars will run during the quieter hours of the day. In the household and in the factory, in the power station and on the railway, the general public will effect economies lessening the demand for coal, and by a reduction of the waste of fuel for purely competitive purposes the community will perhaps unconsciously, but indubitably, take its full vengeance on those who have so wantonly held it to ransom.

PEAT FUEL.

Just in the nick of time, by a mere coincidence, comes Mr. Tomlinson's third dig of the spurs to the Irish landlord, the Irish Government, or the cosmopolitan capitalist, whomsoever of them is most likely to reap the benefit of his action.

Probably he will have to sharpen up his "spurrers" again and again, before the right people will listen to him; but the cause is so good, and its champion so valiant, that we hope he will proclaim his gauntlet thrown until the broad truth for which he is contending is demonstrated beyond cavil.

Mr. Tomlinson's scheme, of which we give an abstract elsewhere in this issue, requires nothing but rough labour, and as much patience as the builders of a railway require before they earn interest upon their outlay; but its very virtues are its bane. Experience has shown that capital can be got for peat schemes with the glitter of electricity and machinery about them, but it fights shy of the fustian of mere drainage.

Naturally enough, now that we are so accustomed to perform all manufacturing processes more cheaply by machinery than by hand labour, it is difficult to realise that there are yet one or two things which can be done more cheaply by a peasant than by an automatic machine; and it will be so difficult to persuade the non-technical and paying public that this is so, unless every member of it is taken to see a bog for himself, that a good case might be made for an educational experiment by the Government. We dislike resort on all occasions to the State, for we are sure that individual enterprise is productive invariably of better results, but the Irish people have been State-fed to such an extent that the backbone is nearly dissolved out of them, and whenever anyone wants to do anything, be it keeping a few hens or building a railway, the aid of the State is invoked immediately with prayer and blasphemy; so that nothing will be done in the bogs, except sink shareholders' money at fairly regular intervals, until the State demonstrates, regardless of expense in the usual way, that a bog can be drained in blocks and sections *à la* Tomlinson at such a cost that the cutting and transporting to the producers will not take the price beyond 4s. per ton of chemically dry (anhydrous) peat.

The Irish Board of Works is well suited for carrying through such an experiment. Its engineers are supposed to know a great deal about the drainage of large water-logged areas; they have at hand the records of various Commissions which investigated such matters during the nineteenth century; and, above all, they have the time to be patient.

The risk to the nation (let us not talk any more about the State) of loss by the experiment would be ridiculously small when compared to the ultimate benefits of success. Listen to Mr. Tomlinson:—Say a bog has an area of 1,000 acres and an average depth of 20 ft. If a purchaser can be found, the value *at present prices* will be £2,000 to £5,000. The bog contains 1,800,000 anhydrous tons of fuel. What is the bog worth to the owner?

Royalties at 3d. per ton	£22,500
Value of reclaimed land, say	10,000
„ „ fuel, say	180,000
Net value of sulphate	330,000
	£542,500

Half-a-million for the sporting owner who never thought of reclaiming anything from the bog except a few grouse, for which he pays about £1 a head. Our Socialists would look after him, and the nation would wake up gradually to the fact that there are 3,000 more of those 1,000-acre lots in Ireland, which Mr. Tomlinson estimates to be worth about twelve hundred million pounds. The Irish Parliament could get some grand taxes out of that!

In other words, Ireland can lay her hand on over eight hundred million H.P.-years, and all the artificial manure she will want for growing anything she likes on the reclaimed land, without going beyond her own shores for it.

Remember, now, that these fairy figures are good "if peat with 50 per cent. of water can be got *standing on the bog* for 2s. per anhydrous ton;" Mr. Tomlinson is under no delusions upon that point, and we must have a determining trial upon a large scale before we can be sure that magic will be wrought on the land.

This is the third paper by the same author, and it is interesting to notice that, while the second was a recantation of the first, this third paper, written after three years, which might have been occupied as before in changing his mind, is a repetition in stronger form of Mr. Tomlinson's second thought. What was done in Holland in the 17th century, and what those very Dutch offered to do for Ireland in 1700, can be done in the 20th century by Irish labour and by Irish brains unless the race has degenerated sadly. Politically, economically, and in the interests of the electrical industry, the burnt offering of 5,000 square miles of black peat would be magnificent. With the effect upon the soul of the country an electrical journal has no call to deal.

Artistic (?) Lamp Standards.

We publish elsewhere in this issue an article on recent practice in American designs for street lamp columns, by an esteemed contributor, to show our readers the lines along which our trans-Atlantic friends are advancing. But we must confess that we are wholly unable to share the author's enthusiasm for the beauty of these designs, some of which, in fact, we should not hesitate to call atrocious—for example, figs. 7 and 10 on p. 480. Apart from the design of the columns, there is a monotony about the spherical globes, turned upwards towards the heavens, or drooping from their stiff supports, which to us is most unpleasing. There is not one of these designs that commends itself to us as suitable for lighting streets—from the æsthetic point of view. *Chacun à son goût*; we do not pose as arbiters of beauty, and others, like our contributor, may hold opposite opinions on this score, but on other grounds we may be bolder, and say that several of the designs illustrated are highly inefficient for street lighting. By using a sufficient number of the columns and expending sufficient energy on them, no doubt a brilliant effect can be secured; but where severe competition has to be met, and the streets must be adequately lighted at the minimum cost—the conditions which obtain in this country—hardly any of the designs shown can be seriously considered.

Electricity in the Domestic Ménage.

Almost suddenly we find ourselves immersed in a campaign designed to bring about the more extended use of electricity in the household. Last week we drew attention to the investigation which has been set on foot by the I.E.E. to determine why the benefits of electricity have not been more fully realised by the consumer; this week we are able to describe the completely successful electric kitchen which is operating on a large commercial scale in Marylebone; and to-morrow, with the opening of the Smoke Abatement Exhibition, a vigorous propaganda will be set on foot, for, as will be seen from the list of electrical exhibitors elsewhere in this issue, a determined effort is to be made to bring home to the householder a knowledge of what can be done—and done best—with electricity. Moreover, we understand that an "At Home" will be given by the President of the Institution of Electrical Engineers at the Exhibition, and the admirable object lesson of an electrical restaurant in full swing—which was so earnestly wished for at Olympia—is bound to create a deep impression. The fact that some of the oldest firms engaged in the manufacture of steam and gas cooking apparatus have now begun to make electrical cooking apparatus clearly shows that its possibilities are being realised, and we hope to see a notable development in this branch of the industry in the early future.

THE SUCCESSES AND FAILURES OF PROFIT-SHARING AND CO-PARTNERSHIP.

By FRANK BROADBENT, M.I.E.E.

During the miners' strike, considerable prominence has been given both in the public Press and in Parliament to the principles of co-partnership and profit-sharing, a large and increasing number of people being of opinion that, in some form or other, the co-partnership of labour and capital forms the solution, and the only solution, of the problem of industrial unrest. A petition signed by over 240 members of Parliament has just been presented to the Prime Minister asking for the appointment of a Royal Commission to inquire how far the principles of co-partnership could be applied to the industries of this country. An analysis of the signatures shows that the petition was signed by 157 Unionists, 72 Liberals, and *only two Labour Members*, viz., Mr. Crooks and Mr. Wardle. There is a widespread impression that the working classes hanker after the supposed huge profits made by capitalists, and it might, therefore, be thought that profit-sharing proposals would be welcomed by them; but those who have noted the attitude of the accredited Labour leaders, more particularly of those members of Parliament who are identified with Trade Unionism, cannot fail to have come to the conclusion that these men are bitterly opposed to profit-sharing in any and every form. One has but to turn to the records of the speeches made by these members at the time when Sir Christopher Furness (as he then was) propounded his system of co-partnery, to appreciate the fact that co-partnership has very little chance of success so long as the present leaders of Trade Unionist opinion retain their influence over organised labour.

The reason for this attitude is not far to seek: It is in the fear that the popularising of co-partnership would eventually destroy Trade Unionism. That it might do so is quite possible, if we regard Trade Unionism merely as a fighting organisation, which appears now to be its chief function; for in a true co-partnership business there would not be, as at present, the two opposing armies of capital and labour, and the only fighting that could take place would be due to mutiny among the co-partners. On the other hand, as showing that there is nothing inherently antagonistic in the principles of co-partnership and Trade Unionism, is the fact that most of the members of the workmen's co-partnership societies are Trade Unionists.

According to a recent Government return, there were in the year 1908 some 303 industrial and provident societies engaged in production and distribution in the United Kingdom. The number of members among whom the profits were shared was about 31,000, and the addition to wages was about 1s. in the £, or, say, 5 per cent. The number of workmen's co-partnership productive societies is about 110, embracing the following trades:—Textile, 19; agricultural, 17; boots and leather, 17; metal trades, 11; building and wood, 15; and printing, 15.

In the year 1910 the capital employed in these societies was about 2 millions, the trade or turnover about 4½ millions, and the profits (including interest on shares, but not on loans) was about £220,000. These amounts are very small in comparison with those for co-operative production as a whole, and are almost insignificant when compared with those for the whole of the manufacturing industry of the country. They serve to show, however, that the workers possess the ability of directing businesses of various kinds successfully. The conditions under which these workshops are conducted is worthy of mention, and it must be admitted that the standard set up is not inferior to those obtaining in the best-conducted company-owned works, and vastly superior to many. There are no hard and fast regulations laid down by any association for the purpose of defining the conditions of work in the co-partnership workshops, but the following conclusions have been arrived at as the result of inquiries made by the journal *Co-Partnership*, replies having been given by 28 societies in the boot and shoe, printing, and textile trades.

These conclusions are that (1) the hours worked are lower in co-partnership workshops than in others in the same trades and districts; (2) That the wages are higher; (3) That women being shareholders gives them an opportunity of voicing matters affecting the welfare of women workers; (4) That regularity of work seems more assured; and (5) married women's labour is minimised to a degree that is unknown elsewhere, and is, in fact, practically prohibited.

In view of these facts, the antagonistic attitude of Trade Unionist leaders to all forms of profit-sharing seems hardly justifiable. The attitude is, no doubt, due in part to the suspicion that any co-partnership proposals emanating from the employers' side are a preliminary step to a general scheme to reduce the rate of wages. It may also be due to the knowledge that the employers' profits form but a small percentage on the amounts paid in wages, and that profit-sharing would not result in any considerable increase in the workmen's weekly earnings. That this is the case is evident from the results given above in connection with the existing co-partnership productive societies, where it was shown that the total profits over and above wages were only about 5 per cent., of which only about one-eighth was available for distribution as dividend to labour after paying interest on shares. It is obvious that, if the workers had voted themselves an increase in wages of, say, 1s. in the £, there would have been no available surplus to pay either interest on shares or dividend to labour. It is equally obvious that wages must be paid either out of profits or capital, so that every successful business concern is essentially a profit-sharing business, although wages are not generally recognised as a share of the profits.

Profit-sharing schemes in which the workers share in the available profits after wages and other charges have been paid, are not necessarily co-partnership systems. There are, in fact, a considerable number of profit-sharing systems in operation in this country, but apart from the gas-making industry there are few, if any, examples of co-partnership arrangements between capital and labour.

The attempts to establish either profit-sharing or co-partnership systems of production in the engineering and iron industries have not been, on the whole, very successful, the following representing the principal attempts:—

Fox, Head & Co., of Middlesbro, in 1866 introduced a system in which the workers received half the profits over 10 per cent. This system was abandoned in 1874. In the year 1867 John & Henry Gwynne, of Hammersmith, gave the men a bonus equal to 10 per cent. on the profits. This was abandoned after a three years' trial. In this case the men had to be non-society men, a condition which may have contributed to the failure. J. Gimson, engineer, of Leicester, introduced in 1872 a system similar to that of Fox, Head and Co., but this was discontinued in 1879, when the profits fell below the minimum. In 1878 Sir Joseph Whitworth agreed to receive deposits from his employés and to pay them the same rate of interest as he received on his own capital. This system is still continued by the present company, Sir W. G. Armstrong, Whitworth & Co., Ltd., the workmen having upwards of £250,000 invested' in the works. W. B. Massey & Co., of Openshaw, established in 1881 a system of profit-sharing by cash bonus, and in the year 1883 Tangyes, Ltd., of Birmingham, issued £50 bonds to their regular workmen, these bonds bearing interest at the same rate as the dividend paid to the shareholders. Six years later the practice was altered to that of paying a fixed rate of interest of 5 per cent. It is to be observed that the workmen did not subscribe to these bonds, which were current for one year only, and were renewed if the workman continued in the firm's employ, but were forfeited on leaving. In 1887 Ross and Duncan, of Govan, established a system by which a share of the profits was distributed either as a cash bonus or as a contribution to a provident fund, according to the votes of the majority of the employés. In 1890 the Thames Ironworks offered to share equally with the men any surplus profits over 10 per cent., but the scheme was rejected by the men after discussing it for three months. In the same year Willans & Robinson issued a limited amount of debenture stock to workmen, and Browett, Lindley & Co. offered to divide with the men one-fourth of the surplus profits, but the scheme was abandoned after one year's trial. Another abandoned scheme is that of Dobson & Barlow, of Bolton, who in 1891 established a system of paying a cash bonus to employés, but discontinued it in 1906.

Among electrical manufacturing companies who have attempted profit-sharing, or given the workers a financial interest in the business, are Crompton & Co., who in 1891 offered for subscription a number of £5 certificates, none of which were taken up by the workmen; and the Brush Co., who in 1893 set aside 10 per cent. of the dividend to be divided, half as cash and half as savings bank deposit, between such employés as "may be nominated as participants."

Robert Mushet & Co., of Bonnington Ironworks, tried a system of profit-sharing in 1892, but abandoned it as "not producing good results." These, with a few other cash bonus systems, are the principal recorded attempts at profit-sharing in the engineering trades. Similar systems have been tried and failed in connection with collieries; and the Furness scheme, as applied to shipbuilding, is one of the most recent attempts at profit-sharing, which, as is well-known, was abandoned after one years' trial, on the vote of the men, although the system did all that was claimed for it. This system, it will be remembered, aimed at being more than a profit-sharing system, the intention being to develop it into a real co-partnership business.

That the principles of co-partnership can be successfully applied to the competitive branches of the iron industries is proved by the remarkable success of the system in vogue at the Guise Ironfoundry, where after an unbroken record of 30 years of co-partnership the entire capital, about £200,000, is now owned by the workers who have received as profits over £277,000, in addition to their ordinary wages. The whole town is conducted on co-operative principles, practically everything being owned in common. Possibly, however, there is something in the French temperament which may account for this remarkable success, as a somewhat similar success was achieved in the business of Maison Leclaire.

In this country the greatest successes in co-partnership are connected with the gas-making industry, which is a non-competitive branch of manufacture. The Livesey scheme adopted by the South Metropolitan Gas Co. 21 years ago set an example which has been followed since by 31 gas companies in this country, representing a paid-up capital of over £47,000,000, out of a total of £86,500,000 for the whole of the gas companies in the United Kingdom. The employés now hold nearly £600,000 in the stock of the various companies, £88,000 being divided among them last year, about half this amount being represented by the South Metropolitan Gas Co.

Co-partnership is very much in the air just now, and whilst there are obvious difficulties in applying the principles fully in a competitive industry like electrical manufacturing, there is less difficulty as regards electrical generation and distribution, which, like the gas industry, is largely non-competitive. A considerable amount of literature has been published on the subject by the Labour Co-partnership Association, and this will repay the study of those interested in the question.

PROPOSED ELECTRIFICATION OF THE CHILIAN STATE RAILWAYS.

[FROM A CORRESPONDENT AT SANTIAGO DE CHILE.]

After considerable study, the Chilian Government decided in May, 1910, to electrify the first section of the railway down the Central Valley, from Valparaiso to Puerto Montt. This section of the Central line runs from Valparaiso to Santiago, a distance of 187 km., through mountainous country, to a height of 519 m. above the sea level. At present there is only a single line, over which the traffic is enormous, and as the cost of building a double track would be very great, the main object of the proposed scheme was to increase the carrying power of the line.

The Committee appointed to study the matter, however, reported that there would be an enormous annual saving in the cost of working, as the consumption of coal over the most difficult part of the track, that from Llai-Llai to Tiltil (Tabon), where the gradient is between 2 and 3 per cent., is very high. On this gradient the road rises, in a distance of 20 km., from 390 metres to 890 metres, on the Valparaiso side, and on the Santiago side from 590 to 890 metres. From Tiltil to Santiago the road falls 71 metres in 50 km. to Santiago.

In accordance with the Committee's proposals, the Government asked for public estimates, in the *Diario Oficial*, dated May 27th, 1910, in which the conditions were published, the estimates to be opened on June 15th following. Estimates were sent in by the Westinghouse Co., backed by Messrs. Giros & Loncheur, French capitalists; and by Siemens-Schuckert, backed by the Deutsche Bank.

During the study of these estimates the Chilian Minister in London called the attention of the Government to the discussion going on in Europe with regard to the merits of the single-phase and three-phase systems, the result being that no decision was arrived at, as the proposing firms suggested different systems of working. It was, besides, pointed out to the Government that between May 27th and June 15th there was not time allowed for the matter to be studied in Europe by other firms, competent and prepared to estimate for the undertaking.

It was also well-known that the two firms who presented estimates had had their engineers on the spot for months studying the matter, and that the period of 20 days was deliberately suggested by them, in order to prevent other firms coming in, they being prepared to divide the undertaking between them.

The Committee itself is divided on the question of the single and three-phase systems, and places great importance on some articles recently published in the *Times*, translations of which have been forwarded to the Government by the Minister in London (Mr. Agustin Edwards). The matter has recently been given serious attention, and there is no doubt it will shortly be settled.

The *Diario Ilustrado* of February 14th states that the Minister of Public Works has decided to ask for new estimates, and to give sufficient time for contractors abroad to study the project, with which object the bases will, no doubt, be published in London, Paris, New York, and Berlin. A certain advantage will, no doubt, be gained by those firms who already have their engineers in the country; amongst them, we understand, is one American firm.

The Chilian Government, however, has such confidence in English undertakings that every facility would be given to representatives of English firms who would promptly take up the study of the undertaking, with the object of sending in an estimate.

The particulars necessary to a preliminary study of the subject would no doubt be found at the Chilian Legation in London, as the Minister, Senor Edwards, would undoubtedly give every assistance possible to firms wishing to go into the matter.

It is high time that British electrical engineers turned their attention to the field of development which is open in Chile, and which, up to the present, has been almost entirely worked by German capital. The State railways some few years ago placed a contract with the North British Locomotive Co. for engines, and these, in contrast to the German engines (Borsig), which had formerly been working on their roads, have given such good results that an English scheme would find the railway authorities already inclined in its favour.

Copper.—The steady hardening of the price of this metal is, naturally, a subject of comment in the leading financial journals. A writer in the *Financial News* for March 9th points out that, although there is still talk of selling combinations in the States, the difficulty of reconciling high-grade and low-grade ore mining interests, and the existence of rich deposits elsewhere (*e.g.*, the French Congo), must militate against anything like a comprehensive association. The figures quoted for highest prices for the years 1902 to 1911 are interesting; they show a steady rise to 1906, a slow decline to 1910, and a more cheerful tone in 1911. An article in the *Times* of March 7th emphasises more strongly the decline in visible supplies, especially their falling-off since October last. It also draws attention to the increase in European consumption, and to the improvement in the situation now commencing to be felt in the U.S. The general enhancement of prices is, of course, dependent on the duration of the coal strike, but, as those countries where an intelligent direction of labour is still possible will naturally absorb the trade of those unfitted to retain it, the balance will probably remain in favour of the rise.

D

FLUE-GAS EXPLOSIONS.

By EDW. INGHAM, A.M.I.M.E.

There is probably no subject bearing on the working of steam plant, about which so little has been written as that which forms the title of this article.

Explosions of gas in the flues of steam boilers are of pretty frequent occurrence, but as they are not usually attended with very serious results little is heard about them by the general public. The greatest danger to which a flue-gas explosion gives rise is that of burning the fireman. When an explosion occurs, there is a liability to blow open the furnace doors, and to drive the hot fuel on the furnace grates out across the stoke-hold, in which case, should the fireman happen to be in the line of fire, he is liable to be badly burned. Apart from this, there is no real danger, but a good deal of trouble and annoyance may be caused by these explosions in the shape of damaged brickwork and flues, and possibly straining and consequent leakage at the boiler seams. In a number of instances where explosions have occurred, a portion of the surrounding brickwork has been completely blown down, the boiler coverings have been lifted off the whole length of the boiler, and the tops of the economiser chambers, which chambers, by the way, are especially liable to flue-gas explosions, have also been blown away.

Although usually of a mild character, comparatively speaking, several disastrous explosions of vessels subjected to steam and water-pressure have been attributed to explosions of flue gases. One of the most notable of these was that which occurred in connection with a fuel economiser at the Agecroft Print Works, near Manchester, many years ago. In this particular instance, one of two economisers which were employed at the works was blown to pieces, many of the economiser pipes being projected to considerable distances; the brickwork covering and the back end of the boiler house were blown away, and the extent of the damage was estimated to be between £500 and £600. Although attributed to an explosion of gas in the economiser chamber, it is doubtful if such was the true cause of the accident. The fact that the safety valve of the economiser was found fast and inoperative after the accident would appear to show that the economiser itself exploded; the safety valve of the other economiser, which worked under precisely similar conditions, was in perfect working order.

Another notable explosion of an economiser was that which occurred at the Stanley Mill, near Oldham, in 1885. This explosion was a most disastrous one, inasmuch as it led to the death of four persons and injury to many others, not to speak of the damage to property which was incurred. At the Board of Trade inquiry which was subsequently held under the Boiler Explosions Acts, the Commissioners attributed the accident to an explosion of gas in the economiser chamber.

Here again, however, there is good reason for believing that such was not the true cause of the accident. An independent expert was called in by the coroner to report on the case, and after a very thorough investigation gave it as his opinion that the explosion was due to over-pressure brought about by an inoperative safety valve which had become frozen up. The jury accordingly gave a verdict to the effect that "the explosion was caused by excessive pressure of steam, generated within the economiser."

This explosion, and the differences of opinion which were entertained as to its true cause, led to considerable controversy at the time as to whether or not a flue-gas explosion could really be responsible for so much damage. At the present time the opinion is generally entertained by engineers that an explosion of gas is not likely to cause a vessel containing steam and water under pressure, such as an economiser or a steam boiler, to explode. Nevertheless, it is quite within reason to suppose that, in the case of a vessel which has become seriously weakened by internal and external corrosion, the shock resulting from an explosion of gas may be so severe as to cause failure of the vessel, and consequent explosion. Hence, where seriously-weakened steam boilers and economisers are concerned, a flue-gas explosion may possibly be attended with disastrous results.

Fortunately, it is not difficult to prevent explosions of gas in boiler flues; a knowledge of the circumstances under which these usually occur will enable the fireman to adopt the means necessary to avoid such occurrences.

When coal is thrown into the furnaces the hydro-carbons it contains are rapidly distilled off. Under ordinary conditions of working, these hydro-carbons are intimately mixed at high temperature with a sufficient quantity of air, and are consequently burned to carbon dioxide (CO_2). When, however, the fires are banked at stopping times, and the dampers closed, the above conditions, which are essential for proper combustion of the fuel, do not obtain. The air supply is restricted and the temperature of the distilled hydro-carbons is comparatively low; consequently, the latter pass along the flues unconsumed, and are thus liable to lodge in the flues, as their way to the chimney is barred because of the dampers being closed. Consider now what happens when the fireman restarts. The first thing he does, after seeing that the water level in the gauge glass is right, is to open the fire-doors for the purpose of breaking up the fires. The opening of the doors allows cold air to rush into the flues, and this air passes along and mixes with the unburnt hydro-carbons, unless, of course, the dampers have already been opened so as to allow the gases to escape. The air and the hydro-carbons together thus form an explosive mixture, and the flame produced by the breaking-up of the fires passes along the flues, ignites the mixture, and so causes an explosion.

This is the way in which flue explosions are usually brought about. It will be observed that before an explosion can occur the following conditions are apparently necessary: (1) Some of the hydro-carbons from the fuel must pass off unconsumed; (2) there must be a chamber or cavity in which the unconsumed hydro-carbons can accumulate; (3) a quantity of air must be admitted, sufficient to form, with the unconsumed hydro-carbons, an explosive mixture; (4) a flame is necessary to ignite the explosive mixture, and so produce an explosion.

By preventing the fulfilment of these conditions, flue explosions can, generally speaking, be avoided.

Thus, in ordinary working, and with efficient combustion of the fuel, neither of the conditions (1) and (2) would obtain, as the hydro-carbons would be mixed with a plentiful supply of air and would, therefore, be properly burned, whilst the dampers, being fully open, would allow all the gases to pass out of the flues and away up the chimney. In some instances, however, both of the above-mentioned conditions may be met with during working periods. When, for example, the fires are so heavily charged with fuel that the latter nearly reaches the furnace crown, the air supply is restricted, and consequently the combustion of the whole of the hydro-carbon gases cannot be properly effected, and the unburnt gases therefore pass along the flues; but if the flues have been built as they should be, and if the dampers are fully open, there is no place where the unburnt gases can collect, and these are therefore swept out of the flues. In many cases, however, overhead cavities exist in the flues; or, perhaps, the dampers are only partially opened. Under such circumstances, the hydro-carbons may rise and fill the cavities or the space above the damper openings, and thus remain lodged in the flues. All the conditions necessary for an explosion then exist, and an explosion is thus liable to occur.

It will be obvious, therefore, that in building the brickwork flues of steam boilers, economisers, &c., cavities, chambers, or any places in which it would be possible for gases to accumulate, should be avoided as far as practicable. When a lifting damper is only partly opened, a space is left above the damper opening, and for this reason, swivel dampers are to be preferred, inasmuch as these leave no overhead space when partly opened, but allow both the lighter and the heavier gases to escape.

In some cases cavities and collecting chambers cannot very well be avoided. Sometimes it is necessary to place the dampers low down at the end of a side flue, and this arrangement is a very favourable one for flue-gas explosions. Generally, where such arrangements exist, or where there are cavities in the flues, the risk of flue explosions may be

obviated by connecting the highest parts of the cavities with the chimney stack, so that there will be a way of escape for any gases which tend to collect.

Again, in the case of economisers, the chambers are very suitable for the collection of explosive mixtures; and hence, in order to minimise the shock which would result in the event of a gas explosion occurring, flap doors are sometimes fitted into the sides and top of the chamber. Similarly, loose blocks are sometimes provided in the side flue covers of Lancashire and Cornish boilers, so that should an explosion occur, it will find vent by blowing off these blocks, instead of, perhaps, blowing down a portion of the brickwork envelope.

In some instances, much trouble from flue explosions has resulted through the use of forced-draught arrangements on the boilers.

The use of forced-draught appliances is, in many cases, to be put down to the fact that the natural draught is defective. During the process of charging the fires, therefore, the whole of the hydro-carbons do not become consumed, owing to the absence of a good draught to provide an ample supply of air. Hence, if any cavities exist in the flues the unconsumed gases may accumulate therein, and may be ignited when the forced draught is turned on and the fires brightened up.

At some works where much wood-working is done, wood cuttings and shavings are sometimes used for firing the boilers, and at such places flue explosions occasionally occur. As in the case of heavily-charged fires, defective draught, &c., a restricted air supply is the fundamental cause of these explosions—the charred residue blocks up the spaces between the fire bars, and so chokes the supply of air entering the furnaces through the grates.

As already pointed out, flue explosions are most liable to occur when starting up the boilers after the fires have been banked. Before breaking up the fires, therefore, it is always advisable to open, and leave open, the dampers for a few minutes, so that any explosive mixtures which may have formed during the period of stoppage may be swept out of the flues before they can become ignited.

Where lifting dampers are employed, the risk of explosion may be minimised by drilling one or two holes at the upper parts of the dampers, or the latter may be left open for a considerable time after banking up or heavily charging the fires. The gases are, of course, most rapidly distilled off the fuel just after the fires have been charged, and by leaving open the dampers for some time after firing up, the distilled gases have a proper chance of escape before the dampers are more closely shut down.

AN ELECTRIC MOTOR-CAR WITH EDISON STORAGE BATTERY.

A TYPE of motor-car which has been in service in the United States, and is made by Messrs. S. R. Bailey and Co., of Boston, is equipped with the Edison storage battery. It is claimed that this roadster, with a standard battery and motor equipment, can be run on one charge of the battery for 80 to 100 miles with an average speed of 20 miles per hour over ordinary roads, including hills, and that such a performance is not merely a top result, but a fair representation of everyday practice. The car is very light, but of strong construction, and has its centre of gravity fairly low, which lends itself to high speed and easy riding. The front end of the car is hung above and in the middle of a long cross spring extending almost the entire length of the front axle, and this point of support, at which there is a ball and socket joint, is well above the centre of gravity. This type of suspension produces a tendency for the car to lean inwards when going round a corner, instead of outwards, as is the case with other vehicles. The ball-and-socket joint allows the easy oscillation of the front axle when one wheel is raised in passing over an obstacle, the body being lifted only half as much as in the case of the usual suspension. The rear of the body or chassis is hung from two points at the top, upon two elliptic springs running parallel to the length of the body and close to it. The frame is of wood construction, strongly braced with steel, and forms both the body and the battery compartment. By lifting hinged metal hoods, the motor, controller, all the driving mechanism, and every cell of the battery are open to easy inspection. The car has seating for two persons, with abundant carrying space in the rear of the seat for luggage.

The control includes a steering wheel with a controller lever mounted on the top of it similar to the throttle control on a petrol car, and easily moved by a finger of either hand. By the addition of a foot switch, eight speeds forward and four reverse speeds are obtained. The brakes are operated through foot levers.

The standard battery equipment is 50 cells, having an initial capacity of 225 ampere-hours or 13·5 KW.-hours. It appears from tests that the capacity can be maintained for over four years, and with use it increases 15 to 25 per cent. It is claimed that the Edison battery has an initial power capacity per pound more than 50 per cent. in excess of any other battery, while after about one year's service the capacity of the Edison cell is nearly twice that of any other battery used for an equal length of time. Moreover, this type of cell can be charged at very high rates, when necessary, without injury. It is not injured by being overworked, and it may be left standing in any state of charge for any length of time. The cells are light, and can be easily handled and the only attention required is to replace the electrolyte about once a year, and occasionally to supply a little distilled water. The motor is one especially designed by the General Electric Co., of America, and operates under severe conditions with high efficiency; it is rated at 48 volts and 40 amperes, and has a normal running speed of 1,200 R.P.M. The motor is suspended under the rear hood, driving a jack-shaft through a silent chain gear; from the shaft the power is transmitted to the rear wheels by a double chain drive.

The Edison Electric Illuminating Co., of Boston, have seven of these cars in operation, and some figures may be given with regard to one of these roadsters equipped with a battery of 25 per cent. less capacity than the ordinary equipment, which was run on October 8th and 9th, 1911, between Boston and New York. In making this run no attempt was made to cover the distance with a minimum number of charges. A charge was taken at New Haven, where the night was passed, and short charges or "boosts" at Worcester, Springfield, and Stamford, where stops were made for meals. Mr. W. H. Francis, of the Boston Edison Illuminating Co., was one of the passengers and kept records, which he made public at the Convention of the Electric Vehicle Association of America, as follows :—

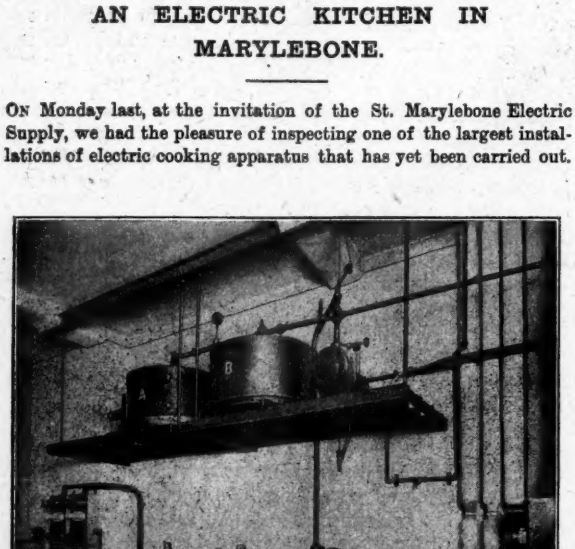
	Miles.	Hours.	Miles per hour.	Amp.-hours per mile.
Boston to Worcester ...	45	2·15	20·0	2·70
Worcester to Springfield...	53	2·30	21·2	2·55
Springfield to New Haven	64	3·12	20·0	2·77
New Haven to Stamford...	43	2·0	21·5	2·58
Stamford to New York ...	39	2·15	17·3	2·23
Totals	244	12·12	20·0	

On examining the figures shown by this table, a very impressive testimony will be observed as to the efficiency of the electric motor-car, and it is to be sincerely hoped that before very long we shall see in Great Britain something analogous to this.

Tool Steel Direct from the Ore.—According to the *Journal* of the Franklin Institute, experiments have been made upon the direct production of steel from magnetite ores containing titanium and traces of vanadium, in a cylindrical furnace 18 in. high and 14 in. in diameter, with two lateral graphite electrodes 1 in. square. The maximum power used was 200 amperes at 110 volts. The slag and ore were first fused by an arc between the electrodes; then the electrodes were dipped in the bath. The ore contained 51·45 per cent. iron, 7·5 per cent. titanium, 0·12 per cent. nickel, and traces of vanadium and sulphur. The charge was 100 parts ore, 20 of limestone, and 18 of carbon formed into briquettes with molasses and water in the proportion of 10 : 16. No ferromanganese or other deoxidising agent was used before tapping, and sound ingots, 3 lb. in weight, were obtained. This could not be done with non-titaniferous ore. The metal was tool steel of good quality. The total cost of ore, coal, limestone, power, and electrodes is estimated at 2 cents per 1 lb. of steel.

AN ELECTRIC KITCHEN IN MARYLEBONE.

On Monday last, at the invitation of the St. Marylebone Electric Supply, we had the pleasure of inspecting one of the largest installations of electric cooking apparatus that has yet been carried out.



Electric Steam Boilers and Electric Boilers for Puddings, &c.

This electric kitchen caters for the staff and employés of the "Marylebone Lane Power Factory"—which is not, as one might suppose at first sight, the electricity works of the Borough Council, but a large dress-making establishment—and provides for the supply of some 400 dinners and 500 teas daily. As a matter of fact, it could deal with a much larger output, but the accommodation available sets a limit to the number of customers. The whole of the operations are carried on electrically, with the exception of the hot-water supply, which is provided by an anthracite water-heater in the basement, at a temperature of about 150° F.

Emphasis must be laid upon the fact that this is not an experimental or tentative installation; it is a substantial commercial undertaking, which must be judged purely on merit. The question of working cost is here of first importance, for the kitchen cooks not for the general public, but for workpeople, who are supplied with meals at a tariff so low that one wonders how it can possibly be done at the price. We shall return to the question of working cost later, after we have briefly described the installation.

This consists of the following items: Seven electric ovens, 24 in. × 26 in. high × 21 in. deep; two small hot cupboards, 19½ in. wide × 24½ in. high × 22 in. deep; one large hot cupboard, 9 ft. 6 in. long × 14 in. high × 21 in. deep; one hot cupboard in dining hall, with six shelves, for warming the dinners of those employés who prefer to bring their own food, each of the six spaces being 7 in. high × 26 in. wide × 15 in. deep; two hot cupboards 40 in. long × 23 in. high × 23 in. deep, in the serving room, with carving tables on top; three tea urns, 4 gallons capacity each; two electric steam boilers supplying steam to four large vegetable steamers at 15 lb. steam pressure, the steamers being capable of cooking 4 to 5 cwt. of potatoes per hour; four boilers for cooking meat puddings, vegetables, &c., also fitted with steaming tops for cooking with saturated steam; one boiling pan is fitted with a heavy tinned-copper interior vessel to form a bain marie for cooking custards, sauces, &c.; one hot plate, 36 in. × 18 in. for boiling and simmering stews, gravies, custards, &c.

The whole of this plant was supplied by the British Prometheus Co., of Birmingham, and installed and erected by the constructional staff of the St. Marylebone Electric Supply Department, which also supplies the electricity at ⅔d. a unit.

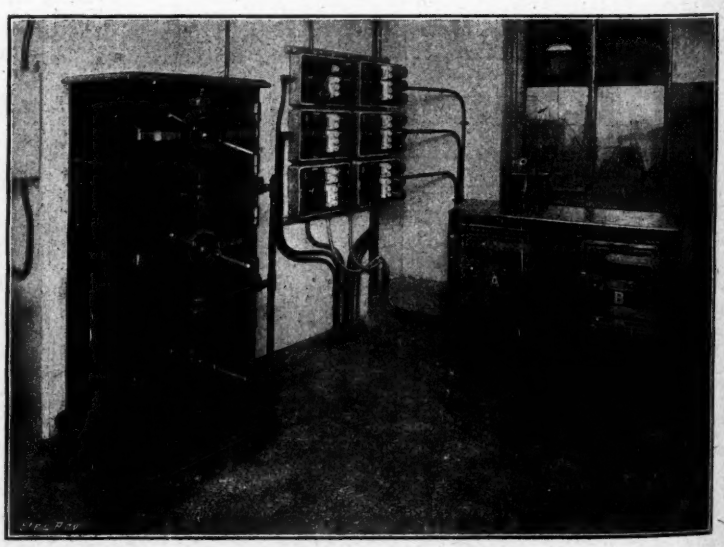
In addition to the plant just mentioned there are one electric grill, 23 in. × 12 in. cooking space, supplied by the General Electric Co., Ltd., and one large fish fryer, 24 in. × 24 in. and 4¼ in. deep, capable of frying 300 to 400 pieces of fish per hour, which was supplied by Messrs. Purcell & Nobbs, of Cleveland Street, St. Marylebone.

Great credit is due to the staff of the Electricity Department, under Mr. A. H. Seabrook, for the admirable way in which the kitchen has been laid out and the apparatus installed. The supply is effected through a three-wire 240-240-volt service, and the building has been wired (by the department) in iron barrel, the job being exceptionally neat and workmanlike. The different classes of cooking apparatus are in this case fed separately through eight meters, for the purpose of obtaining precise data regarding the consumption of each—data which will be of the greatest value to the department in connection with future installations.

The ovens, boilers, &c., are of very substantial construction, resembling the cooking equipments with which the public are familiar, and embodying those features which experience has shown to be essential to success—for be it noted that while an electrical engineer can make an oven easily enough, experience in the manufacture of cooking apparatus is indispensable to the making of the best one. Two of the ovens are shown in one of the accompanying illustrations, as well as the steaming closet for cooking potatoes; between them will be seen the switchboard for five ovens and one of the boilers supplying the steamers. The switchboard is equipped with turn switches and "Dial" fuses, and a lamp in circuit with each of the heating elements, the lamp being fixed behind a red glass screen, and indicating by its ruddy glow the fact that the corresponding element is alive. The method of connecting the apparatus up is worthy of notice; flexible metallic tubing is used, with brass unions sweated on the ends, and the electrical connections are made with rubber-insulated conductors protected by these tubes. No plugs and sockets are used. The ovens, &c., can be moved about freely without breaking the connections, which are not touched by the kitchen staff at any time—the aim being to make the whole equipment fool-proof. Three other ovens, to the right of those illustrated, are built up with hot cupboards between them; and beyond these come two more, like those shown in the view.

The two electric boilers for supplying steam at 15 lb. pressure are to be seen in the other figure, mounted on a platform above the vegetable boilers; the latter stand on wooden trays, and can be used in a variety of ways, and in different combinations. The electric fish fryer is a novel feature; it provides a large pan for hot fat in which the fish are cooked, a grill on which they are drained, and a hot cupboard for keeping them warm.

We must now pass on to the working results, as described by Mr. Clinch, manager of The London Home Delicacies Association, whose firm, besides conducting the business indicated by its title, is one of the largest contractors for staff feeding in London, supplying meals for over 5,000 persons daily. Mr. Clinch, therefore, knows all that is worth knowing about the catering business; he undertook the contract to work the electric kitchen with interest, but with an open mind—a little doubtful, however, as to the reliability and cost of the system—and he reports as follows:—



Vegetable Steamers, Electric Ovens and Switchboard.

"As to reliability: The apparatus has now been working for well over six months, and since it has been installed nothing whatever has happened to put a stop to cooking operations. The way the installation is fitted prevents such an occurrence, and we are satisfied that the apparatus is as reliable as anyone could wish."

As to cost: "We were informed that the cost would not exceed the cost of gas cooking for a similar installation, and our estimate

was made accordingly. The actual cost of electricity used in practice—and we have now had six months' steady working—proves to be lower than our estimate, even at the price of 1d. per unit, and we are satisfied that it would not be possible to work this kitchen, taking all things into consideration, at a less cost by using coal or gas as the heating agent."

That is for the actual cost of energy; but there are other advantages also:—"We can now state it, as a fact, that meat cooked in an electric oven does not shrink to nearly the same extent as meat cooked by other methods. It appears also that this saving in weight is accompanied by an advantage still more important: the meat cooked by electricity retains the juices important to digestion, and also presents a more appetising appearance, and certainly has a better flavour than if cooked in other ways. I should put the saving in weight at approximately 1 lb. in 12 lb. This saving, turned into £ s. d., represents quite an appreciable proportion of the cost of cooking."

"The apparatus is under perfect control by means of the switches provided. The indicating lamps (the lamps light up as each switch is put on) serve to constantly remind the cooks that the ovens are being used at certain temperatures. They, consequently, do not forget to lower the heat when required, with the result that the food cooked is very rarely spoilt by inattention at their hands."

Mr. Clinch goes on to express his appreciation of the great hygienic advantages of electric cooking—the temperature is low, the customary unappetising smell is absent, the electric kitchen is always clean, and the labour needed to keep an ordinary kitchen in a presentable condition is almost eliminated. "Those," he says, "who wish to be at the top of the modern catering business must see and read the writing on the wall: 'Electric Cooking.'"

We are thus enabled to state that the installation here described has proved itself able to meet every commercial, culinary, and hygienic requirement. We may add that it could to-day be purchased at a price no higher than that of its rivals. It will be clear from the report of Mr. Clinch that even at 1d. a unit the electrical system would afford a good margin of saving over the over-all running cost of a gas-heated kitchen, and probably it would be worth while to pay 1½d. per unit on the score of cost alone, while if all its points of superiority were allowed for, the par price might fairly be put at 1½d. per unit.

We heartily congratulate Mr. Seabrook and his staff, and the makers of the apparatus, on the striking success of this installation. Already there is a still larger electric kitchen connected to the mains of the St. Marylebone Electricity Department—that of the new London Polytechnic, Regent Street—which also was erected by the same staff. In due course we shall give particulars of this, and we hope that many other electric kitchens may be called into existence as the result of these examples.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Simplex Electric Toaster.

A new pattern of electric toaster has been introduced by Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, which embodies many improvements in design and construction. The base and frame are one casting, tastefully designed

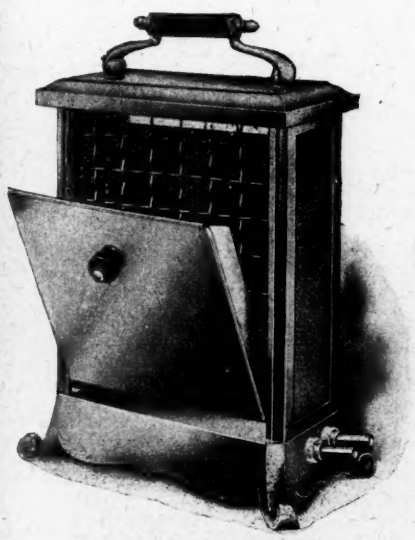


Fig. 1.—Electric Toaster

in a style which the maker's experience in the manufacture of this class of apparatus has shown to be the most popular. The heating element consists of a highly efficient resistance tape of special composition, spirally wound on thin rectangular mica strips which are supported one above the other on the frame. Two slices of bread can be toasted at the same time, and these are held in the correct position for toasting by two hinged sides which also serve to retain the heat. The current consumption is low, but the construction is such as to give very rapid toasting. The device is nickel-plated and is furnished with two pin terminals.

"Zed" Fuse Distribution Boards.

We give below an illustration of a three-phase power distribution board fitted, with "Zed" fuses, for 500 volts, 60 amperes, per way, controlling induction motor circuits. This shows the design to which about 200 ironclad boards have recently been completed by Messrs. Siemens Bros. Dynamo Works, Ltd., for a large power installation. These boards varied in size from 25 amps. to 200 amps. per way, and from one to eight ways. A special feature of the design is the elimination of slate and marble, with the resulting advantage that risk of damage during transit is reduced

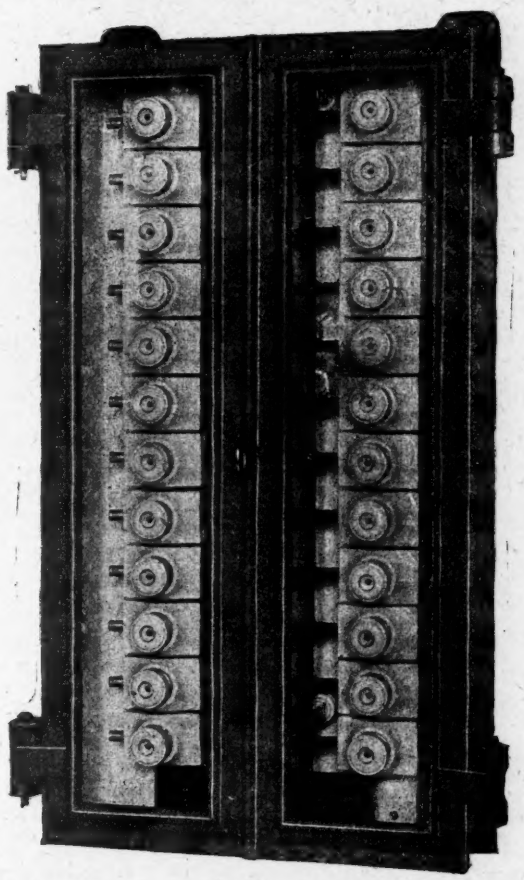


Fig. 2.—Distribution Board for Motor Circuits.

to a negligible quantity. The whole of the insulation of live parts is effected by means of vitreous porcelain, so that the insulation resistance is extremely high. The cases are castings, with fixing lugs arranged so that the backs of the boards themselves project sufficiently far from the wall to permit of conduit runs being taken straight through behind the board in any direction. The hinged doors are arranged so as to be weatherproof, and are provided with detachable hinge pins to facilitate ready removal.

Fuse boards of this class are particularly suitable for use in factories and workshops, especially in positions subject to explosive gases or a dust-laden atmosphere. In this connection we are reminded of the disastrous explosion which occurred some time ago in a Liverpool oil mill; it was stated at the inquest that the explosion might have been initiated by the blowing of a fuse, and in refitting the mill "Zed" fuses have been adopted throughout for the distribution boards.

Alabaster Bowl Fittings.

Messrs. Best & Lloyd, Ltd., of Cambray Works, Handsworth, Birmingham, are now supplying a new line of electric light fittings with alabaster bowls for the purpose of indirect lighting. The use of alabaster is claimed to avoid the ungracefulness of the metal dish and also the casting of shadows, while at the same time it gives a rich and artistic appearance to the fitting. The light is reflected from the ceiling, while a soft glow appears through the alabaster dish. Each dish is unique, no two pieces of alabaster being alike. The tints are variable—some almost pure white, others cream or ivory; some have reddish veins, and others green tints. For the lighting of drawing rooms, boudoirs, smoking rooms or lounges, these fittings with alabaster bowls are claimed to be

both agreeable and luxurious. Full particulars of these fittings are set forth, in four languages, in a catalogue that Messrs. Best & Lloyd have lately issued, a number of different types with different shapes

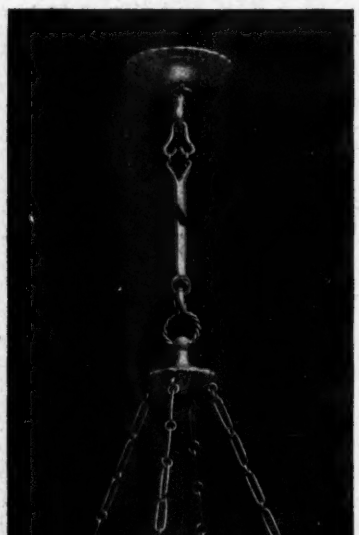


Fig. 3.—One-Light Pendant, with Alabaster Bowl.

of bowls being illustrated therein. A typical example (No. 17,364) is shown in the accompanying fig. 3. It is a one-light polished or oxidised brass pendant, with a 9¾-in. alabaster dish, its overall length being 30 in.

A Large Controller.

Messrs. Electric Control, Ltd., of Bridgeton, Glasgow, have recently shipped a large automatic controller to Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., Newcastle-on-Tyne. This controller is for starting and stopping a 600-h.p. hydraulic pump, twice a minute if necessary. The pump is driven by two 300-h.p. induction motors supplied with three-phase current at 440 volts, 40 cycles. The motors are directly connected to the ends of the pump shaft, their stator and rotor windings being connected in parallel. The voltage between the slip-rings is approximately the same as the voltage applied to the stator, the starting current in both circuits being 900 amperes and the full-load current 750 amperes.

The controller consists of one triple-pole switch for the stator circuits, and five double-pole switches for cutting out the rotor resistances, thus giving six starting speeds, the time interval between steps being adjusted by means of vacuum dashpots.

Each switch unit on the panel is exactly the same, although the stator switch, the intermediate rotor switches and the short-circuiting rotor switch are all of different capacities. This is accomplished by taking a double-pole switch of 500-amperes capacity, continuous rating, and connecting the two poles in parallel, thus making it into a single-pole switch of 1,000-amperes capacity. Three of these switches are used to form the triple-pole stator switch, and two to form the last rotor switch. The five switches on the top half of the panel thus form one T.P. and one D.P. switch of 1,000-amperes capacity, and the remaining switches on the bottom half of the panel each form a D.P. switch of 500-amperes capacity, continuous rating, which is more than ample for the short time they are in circuit. Each switch is assembled on a 2-in. slate panel, and the panels are mounted on a heavy angle-iron frame.

The switches are built on the same principle as the A.C. patent controller standardised by this firm. The switch levers are fitted with laminated copper brushes and with auxiliary and main sparking-tips. The magnets are all operated by single-phase current from the main supply. When energised, they close the switches through a toggle mechanism, which is designed so that the magnet plunger is free of the mechanism in the "up" position, and thus it is impossible for any vibration to be produced at the switch contacts, which is the most essential feature to be obtained in A.C. magnet switches.

The controller itself is controlled by means of a tappet switch operated by two tappets on the hydraulic accumulator. When the accumulator falls to its lowest level, the tappet switch is closed by one of the tappets; this closes the solenoid circuits of the three switches which form the stator switch. These immediately close, and thus start-up the motors with all the resistance in the rotor circuits, the other switches following in succession with a sufficient interval of time between them. When the short-circuiting rotor switch closes, the intermediate switches automatically open, and

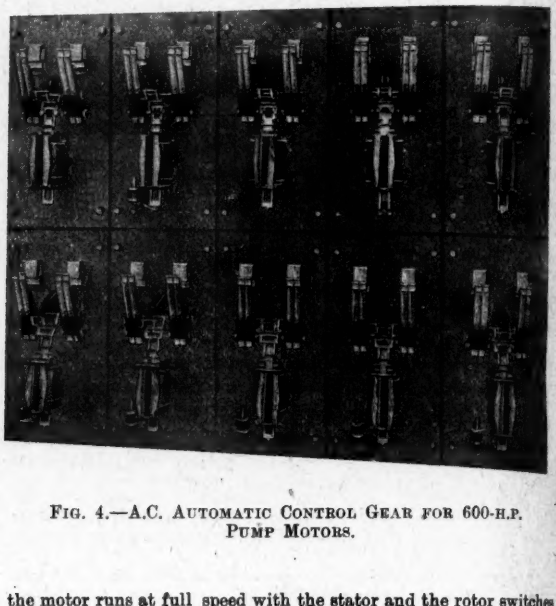


Fig. 4.—A.C. Automatic Control Gear for 600-h.p. Pump Motors.

the motor runs at full speed with the stator and the rotor switches closed. When the accumulator rises to its highest level, the tappet switch is tripped open, and this opens the controller and so stops the motors, the main circuit always being broken on the stator switch.

A considerable amount of resistances is required for this controller. They are built up on three separate angle-iron frames. Each set is fitted with a slate panel with terminals and cable sockets, so that the connections between the resistance terminals and the terminals on the controller panel can be easily and quickly made. The resistances weigh altogether 4,000 lb., and the controller 3,000 lb. The dimensions of the controller are 7 ft. 6 in. wide by 6 ft. high, and each resistance frame is 5 ft. wide by 4 ft. 6 in. high.

This is probably the largest A.C. automatic controller installed in this country, the maximum capacity of the control panel, as shown in the illustration, being 900 H.P. at 440 volts.

"Vickers" Control Gear.

We are informed that our note last week was not quite correct; the wire-on-porcelain resistance unit is only used in their motor-starting gear by the Electric and Ordnance Accessories Co., Ltd., the resistances for their controllers being more often of the cast-iron grid type.

LEGAL.

Tramway Accident Claims.

A special jury sitting with Mr. Justice Phillimore, in the King's Bench Division, on 13th inst., awarded to the widow of a brewer's carman, compensation to the extent of £600, against the London County Council, as owners of the electric tramway system, and the London General Omnibus Co. for the loss of her husband. The plaintiff was Mrs. Elizabeth Shipcott, and her husband was engaged on September 11th last in delivering beer at "The Bell" in Shoreditch. A motor omnibus crossed the tram-line, and was in the act of passing the deceased, who was standing against his dray, when a tramcar, proceeding in the same direction, collided with the omnibus, driving it against the dray, and wedging the man between the two vehicles. The result was that the man received injuries which proved fatal. The case for the plaintiff was that the tramcar driver was negligent in not applying the brakes in time, and that the omnibus driver was also negligent in getting into the position which caused the accident. The defendants each sought to cast the blame upon the other, but the jury found a verdict against both, awarding damages as stated.

At Manchester Assizes on Tuesday, before Mr. Justice Bray, a claim for damages was heard in which the plaintiff was Mrs. Phœbe Shaw, of Barrow, and the defendants, the British Electric Traction Co., of Barrow-in-Furness.

Plaintiff stated that on February 8th of last year she was travelling by car to Dalton-in-Furness. She had to change cars, and met with an accident at a terminus in Barrow. She alleged that when the car stopped, and she was about to get off, the car suddenly jerked forward and threw her off.

The defence was that the plaintiff contributed to the accident by her own negligence.

A Doctor said the plaintiff was suffering from traumatic neurasthenia.

His Lordship asked the doctor to put it into common English. Witness said authorities differed in defining it, but it was commonly known as "railway spine."

Mr. Rankin suggested to the witness that on the legal case pending, plaintiff being anxious about it, had been suffering from chronic lawsuit.

Witness: I call it chronic neurasthenia.

The jury returned a verdict for the plaintiff, awarding her £150. Judgment was entered accordingly.

Beaumont *v.* Underground Electric Railways Co. of London, Ltd.,

This case came before the Court of Appeal, composed of the Master of the Rolls and Lords Justices Moulton and Buckley, upon the appeal of the company from the award of the Judge of the West Brompton County Court, sitting as the arbitrator under the provisions of the Workmen's Compensation Act, in favour of the administration of Allen Beaumont, who, before his death, was employed as the feed pump attendant at the company's generating station in Lot's Road, Chelsea.

Mr. Shakespeare, in support of the appeal, said it was based upon the ground that there was no evidence on which the County Court Judge could have come to the conclusion that Beaumont's death was occasioned by an injury or accident arising out of, and in the course of, his employment. The facts were these:—

Beaumont, the deceased man, in May, 1909, while in the service of the appellants, met with an admitted accident, but from the effects of that accident he entirely recovered. Beaumont afterwards developed valvular disease of the heart. On September 20th, 1910, when at work, he complained of a pain in his side, and left off work. He went to two hospitals, and afterwards died. The County Court Judge held that the man's work was too much for him, and that the heart disease was probably caused by a strain, but he (counsel) contended there was no evidence to justify any such finding.

Mr. Turrell, having supported the award of the County Court Judge on behalf of the respondent, their Lordships allowed the appeal, holding that there was not a particle of evidence to show that Beaumont's death was the result of an accident which arose out of and in the course of his employment.

Judgment was, therefore, entered for the company.

COUNCIL OR COMPANY?

By "CHANGE-OVER."

There is a certain time during the career of almost every central station engineer when he has to decide whether his own interests will best be served by joining the staff of a municipal undertaking or that of a similar works owned by a company. A change from one to the other should not be made without first carefully considering the difference in the general conditions which exist under the respective governing bodies. Many men have spoken in bitter tone after having changed appointments, when it is too late to turn back, and I put forward the following information, with a view to its proving useful to other engineers who may not yet have reached that stage in their career, which calls for a decision to take one road or the other. The step is an easy one to take, but a very difficult one to retrace. Change in a hurry; repent at leisure.

We all have complaints to make. Not one is satisfied with his lot in business; at least, a satisfied man is a rare exception, seldom met with in these days. But some complain of what is their own doing. The company man may complain of many matters appertaining to his work, for the major portion of which there may be some justification. In order to form an opinion, however, his privileges must be weighed against his grievances, and the balance judged accordingly. A company can usually be relied upon to deal fairly and squarely with their engineers. They fill responsible posts, and men of ability possessed of a ready power of initiative, who are quick to recognise advantages, and have the courage to suggest and inaugurate improved methods of working, in any of the various ways open to them, are usually able to adopt them without interference from the directors. Naturally this kind of man is rewarded, as he should be, by suitable increase in salary, and, when occasion offers, additional responsibility. More economical working and improvements in organisation mean money to the company, and they give one a more or less free hand to carry out his duties along the best possible and most up-to-date lines. And they pay him according to his value to them.

The man of energy, providing his energy is real business energy, can make his opportunities and reap the benefits of his labours when employed by a company. The man works with a purpose, and is given to understand that constant attention to his work will surely bring reward in the shape of wages. The company receive more in the way of profit, consequently they can afford to pay the man who is chiefly responsible for the introduction of the money-making ideas, accordingly.

How widely different are the conditions of the municipal engineer. He also complains, and when his privileges are weighed against his disabilities, the balance is more often than not to be found on the wrong side. A municipality seldom treat their officers as they should. They bind him up in rules and regulations—red tape, if you like. Their engineers also have responsible duties to perform, but the man of ability and energy, instead of finding that his efforts for improvement and increased business are appreciated, discovers that there is no opportunity for making use of his talents. He is just one member of a large staff: an item of a big quantity, and opportunity seldom, if ever, comes for him to move ahead more quickly than the whole batch around him, be they slackers or workers. He has certain officers over him, and they in their turn have committees hovering over them, and his only chance of improving his position is by pushing the whole lot, or waiting for a dead man's shoes. The council engineer may be tearing his inside out to do his utmost for his employers; he is a worker, and naturally cannot remain idle; he wants to show how to save money for the department; he is itching to go ahead, to improve and alter, so as to bring in more profit; but he cannot move—his hands are tied. All alterations have to be made through his superiors, who in their turn must necessarily await instructions from committee. Result: much never reaches the committee stage, and the engineer in despair must needs scramble along in the groove made for him until such time as he is fortunate enough to obtain another situation, or is able to step up a pace through someone above him leaving, or growing business luckily favours him in the way of a better paid post. The engineer may work—a good man will always work, pay or no pay, it is his nature—but encouragement to do his best is lacking. Opportunities which he makes are not grasped, because he has not the power to grasp those opportunities. Committee meetings mean delays, and frequently delay means loss. The engineer sees the loss, and is powerless to prevent it. The committee are too busy with other matters to take action, even if they possessed the ability to recognise the opportunity.

The time spent in obtaining sanction for capital expenditure, with a Council undertaking, automatically puts a heavy brake upon its rapidly growing possibilities. Any new work entailing a cost of about £20 has usually to await the sanction of certain committees, who, in their turn, are forced to refer items of any value above that, to a general Council meeting, which often causes weeks of delay before the work can be proceeded with. Again, dealing with larger amounts, it is necessary to take up loans, or obtain tenders by public advertisement for goods and material, and several months will perhaps elapse before the work is well on its way to completion. In this manner a Council take months to carry out what a company would do in about a week. Imagine a prospective customer with a broken-down steam or gas engine, requesting an immediate supply of electricity for driving motors to replace his old plant; what a handicap a Council is to commence with. It is red tape all the time. Work cannot proceed without waiting to receive official sanction, and thereby business is lost, and business means money. Suppose a job offers, costing about £200, for main-laying, &c., with an estimated revenue of £150 a year guaranteed; a company would have the current on within a very short time after receipt of the application

for supply, but with a Council weeks will elapse before sanction is obtained for the work to proceed. When a company receive such an application as this, the applicants are marvelling at the smoothness of electric driving almost before they are aware of their gas being turned off, or of their obsolete steam plant being cold. This kind of consumer talks, which is the best advertisement possible, and many are the possible new consumers likely to come along through one smart piece of work of this kind.

Consumers naturally prefer a supply from the local authority where possible, because of the fact that charges for energy supplied by municipal undertakings are generally lower than in districts supplied by private enterprise. This rate depends largely upon the load factor and initial capital expenditure, which latter item is far higher in a company works than in a municipal undertaking. The tendency with a local authority is toward lower charges, as the works grow. The private companies have always their dividends to consider, and their districts, generally speaking, are not quite so favourable as the majority of Council areas.

In conclusion, I think the balance of advantage remains with the company service. There, when opportunities occur, they can be grasped and utilised to one's personal benefit in the end. With a municipality, it is just a question of waiting for a dead man's shoes. The man who has managed somehow to get placed on a scale where his salary automatically increases by small amounts annually, and who is satisfied to rub along without exerting himself too much, is better off in a Council station. On the other hand, a worker with a decent head on his shoulders, who wants to be paid for his ability, had far better stick to a company and use his abilities for his own betterment.

BUSINESS NOTES.

Lighting Plants Wanted for Canada.—The Commissioner of the Commercial Bureau, Brandon, Manitoba, would like to hear from manufacturers of electric storage lighting plants that are suitable for farm-houses. Mr. Langdon states that if firms will send illustrations and all particulars to him, he will put them in the hands of an intending customer.

Engine Foundations.—From Messrs. Mitchells, Ashworth, Stansfield & Co., Ltd., 23 and 24, Old Bailey, London, E.C., we have received some lists relating to their "Mascolite" felts for reducing vibration and deadening sound. Amongst recent orders received by them is one for "Mascolite B.U.," 1 in. thick, for an engine foundation at the Belgravian Steam Works, Brewery Road, London, N., with Mascolite washers and bushings for the bolt holes in the engine bed. (Architects, Messrs. Taperell & Haase.) Another order is for "Mascolite B.U.S.P." (specially waterproof quality) 1 in. thick, for gas engine foundation 802 sq. ft., for Olympia Theatre, Coalville, near Leicester. (Electrical engineers, Messrs. Baughan & Co., London Street, Reading.) "Mascolite I.R." carriage body pads, 6 in. × 3 in. × 1½ in., quality F.H. (with two layers ¼ in. rubber insertion) is being supplied for Ceylon Government railways. "Mascolite P.S.P." (specially waterproof) permanent-way pads ½ in. thick, for the State Railways of France (formerly Western) is to be used on a viaduct in the immediate neighbourhood of Poisey Station (Seine et Oise).

White City Exhibitions.—We have received from Sir Owen Phillips, the chairman of council of the Latin-British and South American Exhibition, 1912, the following figures regarding the increase in British exports to France and Japan since the Franco-British and Japan-British Exhibitions held at Shepherd's Bush. They are taken from the French official statistics recently published by the Administration Generale des Douanes (the French Custom House) and from a Japanese official source:

British exports to France.—In 1908 they were 790,363,000 fr.; in 1909 (the year following the Franco-British Exhibition) they reached 884,163,000 fr.; in 1910 they were 926,826,000 fr.; and in 1911 they were 1,020,827,000 fr.

British exports to Japan.—In 1909 the value amounted to 86,227,750 yen; in 1910 (the year of the Japan-British Exhibition), 94,700,911 yen; in 1911, 111,156,768 yen.

It is hoped that the forthcoming Exhibition will have, as one effect, the stimulation of export trade to France, Italy, Spain, Portugal and South and other Latin-American Republics.

Osram Undaunted.—We have received from the General Electric Co., Ltd., a photographic reproduction showing the behaviour of an Osram lamp which met with a remarkable accident recently at Sunderland. The wire just above the holder fused, and, of course, the lamp and the heavy glass shade fell to the floor, a distance of 10 ft. The point of the lamp stuck in floor, and the lamp remained standing upright undamaged, whilst the glass shade was smashed to atoms.

Electric Cookery Demonstration.—A demonstration of electric cooking was recently given at Watford by the Electric and Ordnance Accessories Co., Ltd., in collaboration with Messrs. A. Couldrey & Co., who demonstrated their Dreycool cookery bag, using an "Eclipse" electric cooker for that purpose. Mr. F. W. Purse, of the Watford U.D.C. Electricity Department, sent out a letter to his consumers, in which he drew their attention to the demonstrations, and pointed out that the "Eclipse" electric cooker was being used entirely for the cooking operations. Demonstrations were given twice daily, from February 26th to March 21st. The demonstrator was Mrs. Lewis, F.C.A., Gold Medallist, who had never before used an electric stove, and had only seen the "Eclipse" cooker for half an hour the previous week; yet within an hour of the stoves being connected up she commenced her first public demonstration, using electricity for cooking, with most successful results. The hall was crowded with people at each demonstration, and very keen interest was displayed in the electric ovens. Mr. Purse remarks that at the present time it is the duty of those connected with electricity supply to educate people up to the fact that cooking can be done better, more easily, and as cheaply with electricity as with gas; this having been accomplished, it will create the demand for cooking appliances without any hesitation on the part of the consumers.

Condensing Plant.—We have received a lengthy list of orders for steam condensing plant recently received by the Mirrlees Watson Company, Ltd., of Glasgow. These include the following:—

Barometric Jet Plants.—Two sets for Messrs. D. Adamson & Co.; a number for sugar companies in East Africa, Formosa and elsewhere; some for Mexico; one set for Messrs. Babcock & Wilcox, Ltd.; one set for Houghton Main Colliery; one set for the Dominion Iron and Coal Co. (per The Canadian Boving Co.); one set for Oldham Corporation (per The Brush Electrical Engineering Co., Ltd.).

Surface Condensing Plants.—One set for the Powell Duffryn Coal Co.; one set for Denaby and Cadeby Main Collieries Ltd.; two sets for Liverpool Corporation (per The B.T.-H. Co.); two sets for Liverpool Corporation (per British Westinghouse Co., Ltd.); one set for Nova Scotia (per Messrs. Fraser and Chalmers, Ltd.); one set for Athens (per La Compagnie Francaise Thomson-Houston); one set for Messrs. F. Smith & Co., Salford (per B.T.-H. Co. Ltd.).

Low Level Jet Condensing Plant.—One set for Maltby Main Colliery (per B.T.-H. Co. Ltd.).

Also the following plant fitted with pumps of the Mirrlees-Leblanc Rotary Type:—

Three sets surface condensing plant for Port Said Tramways (per La Compagnie Francaise Thomson-Houston); two sets Mirrlees-Leblanc Multi-Jet Condensing Plant, for Nixon's Navigation Coal Co. (per Messrs. Bellias & Morcom Ltd.); one set surface condensing plant for Norwich Corporation (per Messrs. Jas. Howden & Co., Ltd.).

Large Chain Drive Installations.—Referring to a notice in our "Contracts Closed" column, that a recent order for chain drives aggregating 800 H.P., was thought to be the largest single order on record in this country, Messrs. Hans Renold, Ltd., inform us that they are just completing a single order aggregating 1,500 H.P., for chain drives for a woollen mill at Keighley. The consulting engineer, who is carrying out the electrification of this mill, decided to use chain drives from motors to line-shafts throughout, and a good many of these have now been installed. An order for chains and wheels for drives aggregating 1,200 H.P. for a single mill was followed by a duplicate repeat order by the same firm of engineers, and as far as installations, as distinct from single orders, are concerned, Messrs. Hans Renold know of many cases where even these figures have been exceeded. As showing the tremendous strides that this form of power transmission is making, they quote their own figures for the past three years:—1909, 48,104 H.P.; 1910, 67,360 H.P.; 1911, 99,642 H.P. These figures represent the horse-power that will be transmitted by the complete drives (wheels and chains) which they have supplied for engineering purposes during the years named.

Book Notices.—*Small Switches and their Circuits.* By W. Perren Maycock, M.I.E.E. 1911. London: S. Rentell and Co. Price 2s. 6d. net.—This book differs from the majority of new publications, inasmuch as it deals with one phase of electrical work, and views it from the standpoint of one particular firm. In an ordinary way this mode of proceeding would be unsatisfactory, but the name of Lundberg is so closely associated with small special switches that in this case the result justifies the experiment. It is now 30 years since the firm of Messrs. A. P. Lundberg & Son was established, and they have always been trying to improve their special designs. In thus limiting the scope of their activities they have been able to make this branch of work peculiarly their own, and their designs now cover practically every requirement of small multiple switch work. After explaining the importance of detail in electric wiring work, the author shows to how large an extent suitable switching arrangements affect the cost of electric lighting, and proceeds to describe Messrs. Lundberg's principal special designs of switches, wall plugs and ceiling roses. A number of diagrams follow, in which both "safe" and "dangerous" methods of wiring are shown, as well as the switches invented to permit of lamps being turned on or off from a number of points. Wiring problems, as they are often called, have for many of us a fascination somewhat akin to a chess problem, and to such persons the diagrams given in this book will be very welcome. They show how seemingly insoluble requirements can be easily met, and open out possibilities of arrangements of circuits which will prove of great value to a contractor advising a client as to the best positions of lamps, plugs and switches. The author has acquitted himself well in a difficult task, and we feel sure that many of our readers will derive much benefit from a study of the book.

The London Chamber of Commerce (Oxford Court, Cannon Street, E.C.) has issued a useful brochure regarding the Manufacturers' Section of the Chamber, with a full list of members of the Section, and giving in broad outline the character of the subjects which have occupied its attention from the year 1897 down to date. At the

end of the book, answers are given to a number of questions that are often asked regarding the organisation of the Chamber and its work internationally and legislatively, and the privileges of membership for the individual member.

"*Journal* of the Western Society of Engineers." Vol. XVI, No. 10. December, 1911. Chicago: The Society. Price 50 cents.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Glasgow: The Institution.

"L'Electricité Domestique." By Georges Mis. 1912. Paris: Dunod & Pinat. Price 2 fr. 50.

"Berechnung von Wechselstrom-Fernleitungen." By Dr. C. Brietfeld. 1912. Brunswick: Friedr. Vieweg & Sohn. Price M. 4.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXIV, No. 3. March, 1912. New York: The Society. Price 35 cents.

"Fortschritte der Elektrotechnik." 1911. Berlin: Julius Springer. Price M. 10.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 3. March, 1912. New York: The Institute. Price $1.

"Atti della Associazione Elettrotecnica Italiana." February, 1912. Milan: Stucchi, Ceretti e C.

"Papers and Reports Relating to Minerals and Mining." 1911. Wellington: The Government Printer.

"Boletin de Ingenieros." Vol. II, No. 6. February 16th, 1912. Mexico: Secretaria de Guerra.

Catalogues and Lists.—Messrs. Julius Sax & Co., Ltd., 24A., High Street, New Oxford Street, London, W.C.—New catalogue of 70 odd pages, divided into two sections, in the first of which are shown a variety of fittings for Holophane glass, while the second contains a variety of forms of Holophane glassware. The book is very fully illustrated, reflector bowl fittings, ceiling fittings, sphere fittings, pendant fittings, cluster bodies, bowl-type reflectors, ornamental reflectors, pendant and upright globes, Stilletto prism, and concentrating reflectors, &c., all being included.

Mr. Harry Moss, 116, Horton Grange Road, Bradford.—Leaflet relating to, and samples of, "Moorit" jointing material for high-pressure steam piping, &c.

Mr. A. T. Murray, 30, Great Charlotte Street, Liverpool.—List of "High Duty" twist drills, giving sizes, speeds, prices and other information. It is claimed that these drills will run at about double the speed of ordinary carbon drills.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Twenty-page list (No. 664), giving illustrated particulars and prices of their "Aston" electric pocket lamp cases, pocket lamps, lamp and torch batteries, small metal-filament lamps, portable lanterns, cycle lamps, travelling and inspection lamps, and other like manufactures—150 lines in all.

The Western Electric Co., Ltd., North Woolwich.—Leaflet No. 11A, giving information relating to "Western" tape and its price. This is the material which was originally placed on the market as "Amazon" tape, the name only being altered.

The British Thomson-Houston Co., Ltd., Mazda House, Upper Thames Street, London, E.C.—New price list of six pages, illustrating the points of merits of the B.T.-H. Edison carbon lamps. The new list gives tables of data and life and the various voltages, sizes, and efficiencies of both standard and radiator lamps. The traction type of Edison lamps is extensively employed by tramway companies. Copies of this list will be supplied in quantities on application.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—New catalogue of 16 pages, containing brief information, illustrations, and prices of a variety of electric heating and cooking apparatus, including laundry and flat irons, glue pots, liquid heaters, kettles, geysers, hair dryers, water heaters, hot water urns, hot plates, electric convectors, luminous radiators, Bastian quartz heaters, &c. A number of simplified designs of cheap radiators are given in the list.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—As a companion picture to the humorous cartoon entitled "Making the 'Onewatt' Lamp," recently issued by the firm, they have now produced a humorous cartoon on the subject of "Selling Tantalum Lamps." In this design the greatly overworked tantalum sales department is playfully depicted, while there is also an illustration of shipping tantalum lamps, showing barrels being tumbled over a parapet on to a steamer below; three instances of travellers' difficulties of a more or less imaginary, but humorous, character appear. One is entitled "Convincing the West," another "Delighting the East," and the third demonstrating the strength of tantalum lamps.

For Sale.—The St. Pancras B.C. has for disposal one 80-kw. Willans-Johnson & Phillips D.C. set and one Willans-Latimer Clark D.C. set. Messrs. G. N. Dixon & Co. will, on March 27th and 28th, sell by auction, at Trefriw, N. Wales, a quantity of electrical mining, ore-dressing and contractors' plant. See our advertisement pages to-day.

New Manufactures.—Messrs. James Bros., of Leys Avenue, Letchworth, Herts, inform us that they have just put on the market new types of measuring instruments for A.C. and D.C., and a new valveless engine and dynamo for bioscope and country house work. The engines are low in first cost, and have only three moving parts. The firm are opening showrooms in London.

A Million Magnetos.—The Bosch Magneto Co. inform us that the millionth magneto manufactured by them has just been received at the London headquarters in Newman Street, W. This is a remarkable record, and serves to illustrate the important part played by the magneto in connection with the modern internal-combustion engine.

The Coal Strike.—A correspondent writes:—"The British Westinghouse Co., Trafford Park, have intimated that they will have to close down at the week-end in the event of the coal dispute continuing. In normal times they employ about 7,500 people. About 1,000 of this number have been suspended from the beginning of the stoppage, but now the remaining 6,500 have received notice, and at the end of the present week it is expected that they also will be idle. The company have not taken this step because of the lack of coal. The prime reason is the impossibility of obtaining working material.

"At Glover's Cable Works, Trafford Park, the continuance of work depends on the length of time the electric power supply will hold out."

Mr. H. D. Boret, 9, Billiter Square, E.C., London agent of the German-Australian Steamship Co., Hamburg, announces advances in rates of freight to Australia and New Zealand, "Owing to the enormous increase in cost of coal."

The *Times* states that the National Gas Engine Co., Ltd., Ashton-under-Lyne, which employed 2,000 workpeople, closed their works on Monday.

Dissolutions and Liquidations.—The Western Electric Co. (Australia), Ltd.—At a meeting held at Norfolk House, W.C., on February 28th, it was resolved to wind up voluntarily, with Mr. Duncan Campbell as liquidator. A meeting of creditors is called for April 1st.

Oudtshoorn Electric Light and Power Co., Ltd.—This company is winding up voluntarily, with Mr. E. West, of 71A, Queen Victoria Street, E.C., as liquidator. Mr. West is authorised to divide among the contributories in specie any part of the assets. A meeting of creditors is called for April 3rd.

Railophones, Ltd.—A meeting is called for April 22nd, at 20, Temple Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. E. Wilson.

Bolton Electrical Co., electrical engineers, 12, Great Moor Street, Bolton.—Messrs. J. Whittle and J. R. Greenwood have dissolved partnership. Mr. Whittle will attend to debts and will continue the business under the same style.

British Tramways and General Construction Co., Ltd.—A meeting will be held at 83, Cannon Street, E.C., on April 18th, to hear an account of the winding up from the liquidators, Messrs. O. H. Smith and B. C. Molloy.

Messrs. H. W. Umney and A. Peckett (Umney & Peckett, consulting engineers and agents, 46, King William Street, E.C.) have dissolved partnership. Mr. Umney will continue the business.

Trade Announcements.—Messrs. Robert Bowran and Co., Ltd., of Newcastle-on-Tyne, have opened a branch in London, Nos. 21 and 22, Mark Lane, Station Buildings, E.C., where samples and particulars can be obtained of their specialities in white anti-friction metals for dynamo and motor bearings, turbines, reciprocating engines, &c., Flangite jointing paste, bitumen solution for the preservation of steel and ironwork, and for coating underground conduits, dynamo and motor-car cases and frames, pumping work, accumulator lugs, stands, trolley standards, &c.

Langdon-Davies Motor Co.—With reference to the notice appearing in our last issue it is announced that all correspondence should be addressed to 110, Cannon Street, E.C.

Mr. John Newby, electrician, of 128, Grange Road, Ramsgate, has opened offices and a showroom at 105, High Street, Ramsgate.

Owing to increased business in Westinghouse-Morse Rocker-Joint silent chain drives for high-speed power transmission, the Westinghouse Brake Co., Ltd., of King's Cross, N., has opened a district office at Standard Buildings, City Square, Leeds, which will be in charge of Mr. G. W. Cosby.

Messrs. E. Brook, Ltd., of Huddersfield, announce that owing to increasing business they have opened a branch at 178, Gray's Inn Road, London, W.C. (telephone No. "2642 Holborn"). This branch will be well stocked, for immediate delivery, with single, two and three-phase motors of both slip-ring and squirrel-cage rotor types suitable for all voltages and frequencies in and around the London area. It will be in charge Mr. Chas. H. Jessop, who until a few months ago was the representative of the Langdon-Davies Motor Co., Ltd. Mr. E. H. Smith, who has been in charge of Messrs. Brook's Leeds branch, will be his assistant.

LIGHTING and POWER NOTES.

Aberdare.—The U.D.C. has applied to the L.G.B. for a loan of £5,000 for extending the electricity station and supplying energy for the tramways.

Ashton-under-Lyne.—The Electricity Committee proposes to visit a number of towns where a certain kind of turbo-alternators is in operation.

Australia.—The Mayor of Perth (W.A.) has announced the decision of the Lighting Committee to take over the Perth gas and electric lighting works immediately. The question of the terms of the purchase of this undertaking was the subject of considerable litigation, ending in an appeal to the Privy Council, which was heard last year, and decided in favour of the gas company. A few weeks ago the Council raised a loan of £525,000 on the London market for the purpose of completing the purchase.

Barmouth.—A scheme for lighting the town with electricity has been referred to the Works Committee of the U.D.C.

Beaumaris.—A scheme is under consideration for utilising the water power at Pwllfanog, Anglesey, for the lighting of Beaumaris and district by electricity.

Bredbury and Romiley.—The U.D.C. has consented to the Stockport T.C. supplying current to the works of Messrs. Pollock & Macnab, engineers, of Bredbury, on the firm paying £1 per annum and Stockport Corporation 5s. per annum, as acknowledgements for the privilege. The Council has also empowered Stockport to canvass the district to ascertain what employers of labour are willing to take current.

Brighton.—The wiring scheme, referred to last week, has been revived by the Lighting Committee of the T.C., which now recommends the Corporation the scheme with the proviso that the Council reserves the right to refuse to supply current to premises more than 30 ft. from any distributing main, unless the cost of the service beyond the distance of 30 ft. is defrayed by the owners or occupiers of premises. If the scheme is now adopted, local wiring contractors will be invited to do the wiring and fitting, and receive 1d. per unit for current consumed.

Burton-on-Trent.—The Gas and Electricity Committee has decided to appropriate £1,000 from the electricity department in aid of the rates for the ensuing year.

Cheltenham.—An official inquiry will, on March 26th, be held into the application of the T.C. for an order to extend the lighting mains to rural parishes in the Cheltenham and Winchcombe R.D.C.'s areas. There is threatened opposition from the former body, the Gas Co., and elsewhere.

Chile.—Don Luis González Edwards has obtained a decree approving plans for the erection of an electric generating station in the town of San Antonio for lighting and power purposes.

China.—At the commencement of the present year the central station of the Compagnie de Tramway et Eclairage de Tientsin was supplying current to 28,065 lamps, an increase of 40 per cent. on the 12 months. Owing to the use of metal-filament lamps, however, the receipts are not showing a corresponding increase.

Continental Notes.—Austria.—The Oesterreichische Electricitäts Lieferungs Gesellschaft, of Vienna, is increasing its capital from £100,000 to £240,000 for the purpose of establishing a central electric lighting and power station in the town of Schatzlar.

Germany.—The dispute between the T.C. of Wilhelmshaven and the Thüringer Gaswerke, of Leipzig, regarding the right of the municipality to install an electric service, has been finally decided in the favour of the former by the Celle High Court. The path is now clear for the erection of a public service in the western parts of the city, while a beginning has already been made with the construction of the electric tramways network.—*Elek u Maschinenbau.*

Russia.—With a view of meeting the increasing demand for current, a new Diesel engine and generator is to be put down at the central station of the Société d'Electricite de Radorn, in the town of Radorn.

Spain.—The joint stock society formed in October last to supply electric current to Barcelona, has placed an order with the Société de Mulhouse (Alsace) for two groups of turbo-alternators of 10,000 H.P. each, producing three-phase current at 11,000 volts. The groups will be installed in the society's station at San Adrian del Besos, and are expected to be working by December.—*Industria e Invenciones.*

Croydon.—The B.C., on the recommendation of the Finance Committee, has appropriated a further sum of £3,500 from the electricity department towards the relief of the rates; and £8,000 from the tramways. These sums, in conjunction with other drastic measures, have saved an increase of the present rates of 7s. 2d. in the £. The chairman of the Finance Committee described the sum taken from the electricity department as 1 per cent. of the capital involved. Alderman Miller, chairman of the Electricity Committee, said that altogether the undertaking had provided £25,000 to the relief of the rates. The Finance Committee recommended that the Electricity Committee be required to present estimates of revenue and expenditure for 1912-13 before any further sums were expended out of revenue for works of a permanent nature, or any further reduction was made in the price of current. Alderman Miller declared that this would greatly hamper the committee; and his amendment that the recommendation be deleted was carried. Councillor Muggeridge said that according to his calculations, the capital expenditure in this department showed a return of 8½ per cent.

Easington.—A poll is to be taken here with reference to the obtaining of a Prov. Order, with a view to the parish being lit by electricity. The Northern Electric Supplies Co. has offered to install 42 lamps, poles, &c., at a cost of £450, payment to be extended over five years.

Grantham.—The Guardians were notified at their meeting on Monday, by the Urban Electric Supply Co., that if the coal strike continued on and after March 23rd, the price of electricity for heating and power would be raised from 2½d. to 4d. per unit.

Gravesend.—The T.C. has declined to give a supply of current to property at Meopham, which is outside the borough. Additional current for power purposes is to be supplied to the Imperial Paper Mills, and a loan is to be applied for for mains extensions, house services, &c.

Great Yarmouth.—The T.C. has entered into an agreement to supply current to the Royal Naval Hospital.

Grimsby.—In connection with its new Immingham Dock, the Great Central Railway Co. has erected a combined hydraulic and electric power station; the electric generating plant installed consists of two 250-KW. horizontal Curtis turbo-generators, one 500-KW. and one 1,500-KW. set of the same type, the largest set being under erection. Three 250-KW. rotaries are installed, and the three sub-stations on the Dock Estate, which convert the generated supply (6,600 volts three-phase) to 460 volts for distribution over a three-wire network, are to have a combined capacity of 1,500 KW. This plant, in addition to supplying lighting, pumping, &c., at Immingham, also supplies 1,200 KW. to Grimsby Docks, 9 miles away, and energy for operating the Grimsby District Light Railway, an overhead 500-volt D.C. trolley line of the Great Central Railway Co. The line is only 5 miles long, and is supplied through a sub-station equipped with two 250-KW. rotaries. The *Railway News* states that special steel under-frame cars to carry 64 passengers and 40 passengers, with two 50-H.P. motors and two 35-H.P. motors respectively, have been supplied by the Brush Co., the electrical equipments being by Messrs. Dick, Kerr.

Govan.—The T.C. has notified that from May 15th, 1912, the price per unit for lighting will be reduced to (*a*) 5d. per unit for the first 365 hours use per annum of the maximun demand, and 1d. per unit for extra units; (*b*) an optional flat rate of 2½d. per unit.

Hazelgrove-cum-Bramall.—The Stockport T.C., in the absence of consent from the U.D.C., having applied to the B. of T. for an order to enable it to supply current to premises in Hazelgrove, the B. of T. has asked for the Urban Council's reasons for refusing consent. The reply sent is to the effect that the Urban Council contemplates making application for a prov. order for E.L., and that under those circumstances it was not prepared to assent to electricity being supplied by any outside authority in the Council's area.

Ipswich.—A L.G.B. inquiry was held on March 14th into the T.C.'s application for sanction to a loan of £9,130 for extension of the electricity undertaking. In the course of the proceedings, Mr. Frank Ayton, the borough engineer, explained that in February last they received permission to borrow for a 1,000 KW. turbo-generator set, which was not yet finished; they were, however, working right up to their limit and would supply at least 1,600 KW. by next winter—their plant capacity at present being 1,611 KW. At the end of February last year the consumers numbered 866, while a year later they numbered 1,104; traction and power units accounted for about 70 per cent. of the supply. A revised application was drawn up, the items being as follows:—Turbine set, £5,865; switchboard, £540; boiler, &c., £2,400; water softening plant, &c., £325.

Lancashire.—We hear from a correspondent that the stocks of fuel held by many Electricity Committees in south-east Lancashire are now rapidly becoming depleted, and it was reported on Tuesday that in many cases the supply of electricity will have to be curtailed during the next few days. In Lancashire coal trade circles there is a feeling prevalent that the strike will not end until the close of the present month.

London.—It has been decided to install electric light throughout the whole of Westminster Abbey. The temporary installation carried out by the Office of Works for the Coronation has proved so satisfactory that it has been permanently adopted, and the service is now being extended to Henry VII's Chapel.

Marylebone.—The Electric Supply Committee has adopted an estimate of £203,672 as the estimated expenditure on revenue account on the electricity undertaking for the year 1912-13. During this period the Committee estimates to sell 12,772,000 units, being an advance of 891,000 over the estimated sales for the current year. With regard to the average price likely to be realised, the Committee has assumed a further diminution of 5 per cent., viz., from 3·32d. to 3·16d.

Stepney.—The Finance Committee of the Borough Council has approved an estimate of a further sum of £500 to enable the Electricity Committee to supply to consumers on hire or hire purchase, apparatus, electrical fittings, &c. It has also been decided that the total liability of the Council to hirers in respect of the supply of fittings, meters, &c., on hire or hire purchase shall not, at any time, exceed £1,500 on capital account.

Fulham.—The Finance Committee has received a letter from the Comptroller of the L.C.C., suggesting that the B.C. should make an arrangement with the L.C.C. to repay by installments (either annually, half-yearly, or quarterly) the electricity loans of the B.C., which are now repayable on the annuity system. Having fully considered the proposal, the Committee has decided to inform the L.C.C. that it does not see its way to make the alteration suggested.

Islington.—A L.T. distributing main is to be laid to Fitzwarren Gardens at an estimated cost of £287, and the thoroughfare mentioned is to be lighted by means of metal-filament lamps at an estimated cost of £61.

St. Pancras.—The Electricity Committee has decided to demolish 73, Pratt Street and Nos. 90 to 106, Great College Street in order that the site may be utilised for electricity purposes. The chief electrical engineer reports that owing to additional load he finds it necessary to increase the feeder mains in the Southern district at a cost of £4,323.

Hackney.—A special meeting of the B.C. was held on Tuesday last to consider the report and recommendations of the Electricity Committee in regard to the proposed scheme of extensions, which was detailed in our issue of March 1st. The work to be undertaken at once is estimated to cost £64,700, which includes buildings costing £25,000 ; one 3,000-kw. turbine set and two boilers, with economiser, draught fan, &c., switchgear, a 1,500-kw. motor-generator, &c. ; some items, such as coal bunkers and conveyors, are, of course, such as will be required for the complete scheme. Probably until the load reaches 4,500-4,800 kw., the ring h.t. mains and sub-stations will not be proceeded with. As previously mentioned, the completed 9,000-kw. station is estimated to cost £12·89 per kw., including £2·89 per kw. for buildings; the first portion (3,000 kw.), £21·56 per kw., including £8·33 for buildings. The 6,000-kw. ring mains are estimated at £4·166 per kw., and the three sub-stations (four 500-kw. converters per sub-station), £5·375 per kw., including £·5 for land, £1·05 for buildings, and £3·8 for plant. The estimated cost of 24 ½-mile ·5 c.c. sub-feeders from sub-stations (6,000 kw.) is £3·824 per kw. The Committee recommends the carrying out of the first part of the work, costing £64,700 ; that sites for sub-stations be obtained (£3,000), and that an architect and quantity surveyor be engaged to act with the borough electrical engineer in carrying out the work. The Finance Committee recommends that application be made to the L.C.C. for sanction to a loan to defray the estimated expenditure, £67,700.

Loughborough.—When news of the breakdown of the coal negotiations reached Loughborough, on Friday, notices were posted up at several large establishments intimating that they would close down or work short time. The most serious action was the closing of the greater part of the Brush Co.'s works, where about 900 men were suspended on Saturday. The firm is full up with contracts, and it is stated that work has not been so brisk for many years as it has been up to the present time. All-night power is cut off.

Lowestoft.—On March 13th a L.G.B. inquiry was held into the application of the T.C. for a loan of £4,500 for electricity purposes, some £2,000 of which has already been spent on urgent work. There was no opposition.

Manchester.—Such a heavy strain is being put upon the Manchester Corporation electricity undertaking by large firms of manufacturers and engineers, in consequence of the shortage of coal, that the department has issued a statement to big power users, intimating that although it has sufficient coal to maintain the electricity supply for at least another month, it is necessary that users shall exercise as much economy as possible.

Norwich.—The Electricity Committee of the T.C. has recommended that a loan of £3,000 be applied for for the erection of offices in Duke Street, and £3,000 for two boilers at the electricity works.

Runcorn.—The Mersey Power Co., Ltd., a subsidiary of the Salt Union, Weston Point, has given notice of its intention, under the Runcorn Electric Lighting Order, of applying to the B. of T. for consent to the erection of a h.t. line for the purpose of supplying energy at 6,300 volts between Runcorn and Helsby, the line crossing over Frodsham Marsh to a sub-station to be erected near the pumping station, Frodsham, thence to Helsby railway junction, and terminating at the works of the British Insulated and Helsby Cables, Ltd., Helsby.

The Chairman (Mr. G. H. Cox) presiding at the annual meeting of the Salt Union, Ltd., at Liverpool, on 15th inst., mentioned that there was an uncalled liability of £37,000, mainly on account of shares in the Mersey Power Co. The electrical power scheme, which was operated in conjunction with the Winsford vacuum plant, had worked well throughout the year. The delivery of the turbo-alternators had been greatly delayed, owing to pressure of work in the contractor's engineering department, and also to labour troubles. The power company had made further large and favourable contracts with various consumers in the district for the supply of electricity, and he believed that, before long, all the available power would be disposed of.

South-West Africa.—The Kolonial Bergbau Gesellschaft intend to erect a generating station for the working of their diamond fields, and also to supply current to the town and to the Imperial Telefunken station at Lüderitz Bay, German South-West Africa.

Tasmania.—According to the *Times* the contracts for the first 9,000-kw. unit for the Great Lake hydro-electric scheme have been awarded to the British Westinghouse Co. for the electric plant and transmission, and to Messrs. Jens Orten-Boving for the turbine and pipe line, &c.

Torquay.—The full amended tariff for current for power adopted by the T.C., and briefly referred to in the last issue of the Electrical Review, is as under: Private consumers having a maximum demand of 1 kw. and over, using 725 units and above per kw. demanded per quarter, 1d. per unit net; between 625 and 724 units, 1¼d. ; between 550 and 624, 1½d. ; between 450 and 549, 1¾d. ; between 350 and 449, 1¾d. ; between 200 and 349, 1¾d. ; below 200, 1¾d., with a meter rent of 8d. per quarter.

Wellingborough.—The U.D.C. has under consideration the question of purchasing the undertaking of the electric supply company. In the meantime, information as to the working of such an undertaking in other towns is to be obtained by a deputation.

Weymouth.—The T.C. proposes to utilise electricity for working the pumps at the Westham pumping station in place of steam. The Electricity Committee has offered to take charge of the whole of the pumping at an annual cost of £567, thereby effecting a yearly saving of at least £600.

Whitehaven.—The T.C. has decided to leave in abeyance, pending the result of the I.M.E.A. Bill in Parliament, the assisted wiring scheme prepared by the electrical engineer.

TRAMWAY and RAILWAY NOTES.

Burnley.—The reduction in the railway service has proved highly beneficial to the Corporation Tramways. Last week over 20,000 more passengers were carried than in the same week of last year, and the officials are looking forward to a record year.

Colwyn Bay.—The Llandudno and Colwyn Bay Electric Railway Co. has appointed a special committee to discuss with the Council all matters in dispute between the local authority and the tramway company, and hopes are entertained that terms will now be definitely settled upon with regard to the extension of the tramway to Old Colwyn. A deadlock had been reached in the negotiations between the two bodies owing to the company declining to comply with the request of the Council for a further payment towards road widening expenses, and the Council decided that, until the expenses in that respect was met by the company, it (the Council) would not be in a position to make further progress with the purchase of land for the construction of this section of the tramway from Llandudno.

Continental Notes.—Austria.—The electrification of the Salzkammergut Railway has been advanced an important stage by the Austrian Railway Administration's announced approval on technical grounds of the plans of Messrs. Stern & Hafferl, of Gmunden, for the electrical equipment, and of those for the distribution lines from the generating station at Gosau, owned by the Stern und Hefferl A.G. ; also the lines crossing the tunnel network to supply the State main system. The Statthalterei, of Graz and Linz, have now been invited to open negotiations to arrange the political and compensation details.—*Der Elektrotechniker.*

Germany.—It is reported from Berlin that official approval of the North-South line has been accorded, the concession having a duration of 90 years. The line must be completed and opened for working by April 1st, 1916, failing which a penalty of 200,000 marks will become due. The Mayor, in anticipation of the official approval, has arranged fresh contracts with the Elektrischen Strassenbahn Gesellschaft, formerly Siemens and Halske.—*Elektro. Zeitschrift.*

France.—Plans in respect of a projected electric tramway between Vallorbe and Bellaigue (Doubs) are in course of preparation.

The provincial authorities of Loire-Inferieure have under consideration a scheme for the construction of an electric tramway between St. Nazaire and Pornichet.

Switzerland.—A project for the construction of a narrow-gauge electric railway between Herzogenbuchsee, Koppigen and Utzendorf is at present under consideration. Messrs. Brown, Boveri & Co., of Baden, are interested in the scheme.

According to the *Standard*, 19 Swiss deputies representing all parts of the country have presented a motion to the Federal Council to examine the question of hastening the introduction of electric traction on all the State-owned railways. The matter is to be discussed in the Swiss parliament at an early date.

Spain.—The official trials of the electric trains on the converted section of the Southern railways between Santa Fe and Gergal have proved eminently successful, both as regards the stations and the trains. The line belongs to the Compania de los Caminos de hierro del Sur de Espana, which it is expected may extend electric traction to the rest of the system.—*Industria e Invenciones.*

Turkey.—The Turkish Minister of Public Works has signed a contract with the railway engineering firm of Lenz & Co., Berlin, for the building and working of an electric railway at a cost of £4,000,000, which will have great results for the future of Constantinople. The line will start from the centre of Stamboul, near the Bagazid Mosque, from thence it will run to the High Porte and the Golden Horn. This latter will be spanned by a bridge to be built, and the line will then continue through Galata to Pera, and thence along the shores of the Bosphorous for 32 km. to the Black Sea. A period of three years is allowed for the completion of the first section, from Kara Koi to Sari Yer, and eight years for the whole of the line. The contractors are likewise pledged to make such street alterations at their own cost as the municipality may deem needful. The working concession covers a period of 75 years. The capital for the undertaking will be provided by a Turkish joint stock company to be formed, half of whose share capital must be subscribed by Turkish subjects.

Italy.—Messrs. Brown, Boveri, & Co., acting in conjunction with the Brussels Chemins Economique have formed at Milan the Societa di Trazione e Imprese Mettriche whose object is the electrification of tramways in the province of Milan.—*Elektrotechnische Zeitschrift.*

Dundee.—It is intimated that there may be a slight delay in the delivery of the equipment for the Corporation's railless trolley system, owing to a strike of Messrs. Siemens's employés and on account of the coal trouble. The tramway manager explained to the Tramway Committee that there was a strike clause in the contract.

Edinburgh.—Mr. Harris, the tramway company's engineer, has devised a new safety guard for attachment to the cable cars. The guard works on the trigger principle. In front is what is described as a gate; any object touching it immediately sets a trigger in motion and the guard drops down close to the ground, preventing anything from going under the car. The mechanism necessitates an extension to the bogie of about 18 in., but this extension gives more room on the platform for passengers and also provides four additional seats at the top. The Tramway Committee of the T.C. paid a visit to the depôt at Shrubhill and inspected the working of the new guard on a bogie, but it is intended to have another exhibition on a running car. The cost of transforming the old to the new arrangement is estimated at £30 per car.

Greenock.—The T.C. had under consideration at the last meeting the proposal of the Greenock and Port Glasgow Tramway Co. to run railless vehicles throughout the higher parts of the town. After discussion it was agreed to obtain information as to other municipal ventures of this kind, with a view to the Corporation taking up the proposal.

Hastings.—The Dolter system of tramways on the Hastings front is giving ground for loud complaints. The matter came before the T.C. a few days ago, when it was resolved that as repeated complaints made to the Tramway Co. as to the danger and annoyance caused by the unsatisfactory working of the cars had had no effect, a representation should be made to the B. of T. In the course of a long discussion strong allegations were made against the company, one being that it was endeavouring to force the erection of overhead wires in substitution for the Dolter system. It was also alleged that the system was worn out, and that the company had not done its best to make it work satisfactorily. The railless system was strongly advocated by one Councillor, but overhead wires, according to an Alderman, would effectively ruin the front. The decision to appeal to the B. of T. was carried by 28 votes to 2.

Japan.—Japanese railways underwent during the year 1910-11 a period of favourable development. Some of them increased their mileage, made new connections, or carried out other improvements. New lines were also constructed. In the summer of 1910 a short, but violent, railway building fever broke out. Some 30 companies were formed, with a nominal capital of 80,000,000 yen, to build railways in the neighbourhoods of Osaka, Kobe, and Kioto. Few reached the stage of realisation, as official sanction was withheld from the major part. Among the new undertakings may be mentioned that of the Kioto-Baba Electric Railway Co., whose line is 16 km. long, and the municipal electric tramway of Kioto of a length of 27 km. Both lines are under construction. With regard to extensions and improvements, the Kioto-Osaka Electric Railway has increased its capital to 3,500,000 yen, to provide for disbursements on improvements of the too-lightly constructed permanent way (1,334,249 yen); installation of an electric light and power station (560,000 yen), and augmentation of rolling stock (532,327 yen). The balance is to be spent on bridge building and other purposes. The Nankai Railway has carried out the electric conversion of 31 km. of the Osaka-Kaidzuka line, and the conversion of the entire 72 km. extent of the line was to be effected by November last. The steam locomotives will be used for goods traction only. To cover the second outlay a loan of 2,000,000 yen has been raised. Parallel to the railway, from Osaka to Saikai, a new electric line will be built, for which purpose the Hankai electric railway company has been launched. The municipal authorities of Osaka have extended their tramway network to 27 km. in length and purpose adding a further 27 km. by 1914. The cost of these works is estimated at 34,000,000 yen. New undertakings, whose completion is shortly expected, are the Okayama electric tramway; the Osaka-Nara electric railway, length about 40 km.; and the Kobe-Takanadzuka electric railway. The electric tramway in Kobe will be extended by an additional 6·4 km. Lastly, an agreement is spoken of between the four electric railways running between Baba and Akashi—the Keishin, Kaihan, Hanshin, and Hiogo companies—for the construction of junctions and the exchange of traffic. Some of the companies, in addition to buying the ground for their lines, have acquired considerable extents of land near their stations, with a view to letting houses and constructing gardens and pleasure resorts to attract the populations of the neighbouring large towns.

London.—The House of Commons Committee last week passed the Bill dealing with the extension of the Bakerloo tube line to Queen's Park in connection with the North-Western Co.'s electrification scheme; also the Edgware and Hampstead Bill, which provides for an extension from Golder's Green.

Stretford.—The U.D.C. has applied to the B. of T. for an extension of time for four years from June 15th next, for completing the railways authorised in the Light Railways Order of 1906, and railway No. 10 of the West Manchester Light Railways Order, 1906.

Tasmania.—The Hobart City Council has decided to purchase the tramways in the city and to offer £200,000 for the whole of the company's assets.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—Various improvements have lately been introduced into the Belgian telegraph and telephone service, and the Belgian Administration intends to make proposals to neighbouring countries—Germany, France, Holland and Great Britain—for the institution of cheaper international telephone rates.—*Der Elektrotechniker.*

London Telephone Service.—The Controller announces that "The Metropolitan Offices of the late National Telephone Co. (*sic*) at Salisbury House, London Wall, E.C.," will after to-morrow be removed to 144A, Queen Victoria Street, E.C., where all communications with reference to the London telephone service should be sent. Subscribers may pay telephone accounts at any Post Office, or remittances may be sent to the above address. It will be noticed that the Telephone Co. is regarded by the Controller as dead already, but he will probably find that it still possesses a remarkable degree of vitality, when the arbitration proceedings commence.

New Premises for Wireless Co.—The L.C.C. has accepted an offer on the part of the Marconi Co. to take the building formerly known as the Gaiety Restaurant in the Strand, on a 99 years' lease, at £6,500 a year.

New Telephone Exchanges in London.—Three new exchanges, situated respectively in Notting Hill, Tottenham Court Road, and Clerkenwell, are in course of construction for the relief of exchanges which are heavily loaded.

Wireless Telegraphy.—Recently an operator on board the P. & O. liner *Mantua*, off Melbourne, clearly read signals that were being sent to a warship by an operator at the Government station at Jask, in the Persian Gulf. The distance traversed was 6,249 nautical miles, and the sending apparatus was of Marconi pattern; the receiver was the Marconi magnetic detector.

Wireless Time.—A society has been formed at Fulda to erect a wireless station for the supply of the correct time to the watch and clock makers throughout Germany. The tower which is to be built will be 100 metres high, and will be fitted with antennæ. Every minute one of the three clocks at the station will close a circuit, the result of which will be the emission of waves. The receiving clocks will advance one minute at each reception. The receiving stations will only need to be fitted with a relatively small antenna; a flagstaff installed on the roof is enough. Each receiving clock can be made to control several hundred secondary clocks, so that an average sized town can be served by a single clock. The system is uninfluenced by stray waves and atmospheric disturbances.—*E.T.Z.*

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—March 23rd. Stores for the Tramways Committee for a year. H. Pilling, general manager.

Australia.—Victoria.—April 2nd. 250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 2nd.—10,000 metal-filament lamps, for the Melbourne City Council. See "Official Notices" March 15th.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" March 1st.

April 23rd.—2000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

April 24th. Power generating plant for the Federal Capital site. Secretary, Department of Home Affairs, Russell Street, Melbourne.

May 1st and 8th. Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors for Melbourne. See "Official Notices" to-day.

Queensland.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" to-day.

South Australia.—April 24th. Telephone and telegraph material, for the P.M.G.'s Department. See "Official Notices" March 15th.

April 3rd.—Insulators, binders, copper wire, &c., for P.M.G., Adelaide. See "Official Notices" to-day.

Western Australia.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

Austria-Hungary.—Banjaluka (Bosnia).—April 10th. Tenders are invited for the erection complete of a hydro-electric station on the Urba River, for the supply of light and power to the city and suburbs. For further particulars see this column last week.

Batley.—March 25th. Twelve months' supply of general stores for the Electricity Department. Borough Electrical Engineer.

Belfast.—April 8th. Two 750-KW. turbo-alternators, condensing plant, and E.H.T. switchgear, for the Corporation. See "Official Notices" March 8th.

Belgium.—April 1st. La Direction du Service Special d'Etudes et de Controle des Applications de l'Electricité, 52, Boulevard du Regent, Brussels, is inviting tenders for the mechanical and electrical equipment of ten pumping stations in connection with the Charleroi Canal.

Birmingham.—April 3rd. Electric motor and centrifugal pump for the Birmingham, Tame, and Lea District Board. J. D. Watson, engineer, Tyburn, Birmingham.

Bristol.—March 28th. Separate tenders for the following, for the Guardians, for Southmead Workhouse:—(2) Boilers, economisers, steam pipes, &c. (deposit £5); (3) electric light generating plant; (4) electric light wiring and fittings; (5) laundry machinery, motors and appliances. Deposits for 3, 4 and 5, £2 each. J. J. Simpson, Clerk to the Guardians, St. Peter's Hospital.

Burma.—March 29th. (*a*) Miscellaneous tools and stores; (*b*) electric generating plants for workshops, for the Burma Railways Co., Ltd. Specification (*a*) 20s., (*b*) 10s., not returnable. Managing director, 199, Gresham House, Old Broad Street, E.C.

Canada.—March 30th. One 1,500-KW. A.C. steam turbo-generating set, and one 500-KW. A.C. generator coupled to Diesel engine, for the City Commissioners of Moose Jaw, Saskatchewan. See "Official Notices" March 8th.

Cape Town.—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

Edinburgh.—March 23rd. Arc lamp globes, cast-iron pipes and pavement boxes, and underground conduits, for the Electricity Department. Deposit 10s. Mr. F. A. Newington, engineer.

Gillingham.—March 25th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" March 8th.

Govan.—March 26th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" March 15th.

Greece.—PIRÆUS.—March 31st. Three electric cranes of 10, 6 and 2 tons respectively for the Harbour Board. Com. Int. Dept., Board of Trade, London.

Halifax.—March 26th. Electrical fittings, for six months, for the Board of Guardians. A. T. Longbotham, clerk, Carlton Street.

Kingston-upon-Hull.—March 26th. Extra-high-tension three-phase switchboard, and 20-ton overhead travelling crane, for the Corporation. See "Official Notices" March 8th.

London.—L.C.C.—Tenders are to be invited for two new engines for driving the mechanical stokers, coal conveyors, &c., at the Crossness pumping station.

March 26th.—Electrical installation at the Morden Terrace School. See "Official Notices" March 15th.

KENSINGTON.—March 28th. Telephone installation at the Infirmary in Marloes Road. Clerk to Guardians, at the Infirmary.

H.M. OFFICE OF WORKS.—March 26th. Carbon and metal-filament lamps for one year. See "Official Notices" March 15th.

METROPOLITAN ASYLUMS BOARD.—April 10th. Two electrically controlled passenger lifts at Tooting Bec Asylum. See "Official Notices" to-day.

METROPOLITAN WATER BOARD.—April 12th. The Board is inviting tenders for 6 Diesel oil engines and two 10-ton overhead cranes for Cricklewood and Fortis Green pumping stations, also one Diesel engine and one 8-ton overhead crane for Green Street Green pumping station. Specifications and forms of tender from the Chief Engineer's Department, Savoy Court, Strand, W.C.

BETHNAL GREEN.—April 2nd. Telephone cables, for the B. of G. See "Official Notices" March 15th.

ST. PANCRAS.—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" to-day.

Limerick.—April 5th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Merthyr Tydfil.—March 28th. Electrical installation at the Municipal Secondary School, Cyfarthfa Castle. See "Official Notices" March 8th.

New Zealand.—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

Norway.—April 1st. State Telegraph Department. Insulators, double-current wire, steel wire cables, and soldering tin. Tenders to Telegrafstyrelsens Kontor, Christiania. Local representation.—*Board of Trade Journal.*

Nottingham.—March 25th. Stores for a year, for the Corporation Electric Tramways Department.

Partick.—April 2nd. Stores and materials for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

Rhodesia.—SALISBURY.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

Rosslynlee.—The Midlothian and Peebles District Asylum invites offers for supplies, including electric fittings. The Treasurer, 19, Heriot Row, Edinburgh.

Shanghai.—April 3rd. 945 single-phase A.C. house service meters, for the Municipal Council. See "Official Notices" to-day.

Spain.—The municipal authorities of Villabanez (province of Vallodolid) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Swinton (near Manchester).—The U.D.C. has decided that tenders be invited for a motor-generator and electric wiring in connection with the lighting of the refuse destructor buildings and yard.

Sweden.—March 31st. The Electrotechnical Department of the Stockholm Municipality is inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). For further particulars, see this column for March 1st.

West Hartlepool.—April 2nd. (*a*) 300-KW. storage battery and booster (*b*) rotary converting plant, for the Corporation Electricity Department. See "Official Notices" March 15th.

Wigan.—March 25th. Stores and materials for the Corporation Electric Light and Tramways Departments. See "Official Notices" March 15th.

York.—April 12th. Two water-tube boilers, with superheaters, automatic stokers, economiser and pipework, for the City Electricity Department. See "Official Notices" to-day.

CLOSED.

Ashton-under-Lyne.—The Borough Education Committee has accepted the tender of Mr. Robert Butterworth for the electric light installation at West End Schools.

Bromley (Kent.).—The T.C. has accepted the tender of Mr. R. E. Knight for the electric light installation at the library extension, at £67.

Chesterfield.—The T.C. has accepted the following tenders:—

Babcock & Wilcox, Ltd.—A boiler for the electricity works, at £750.
British Westinghouse Co.—A Westinghouse-Le Blanc engine-driven condenser, at £497.

Croydon.—The following tenders have been accepted by the Corporation:—

Three high-tension switchboards.—Ferranti, Ltd., £3,612.
Mixed-pressure turbine plant.—Belliss & Morcom, Ltd., £6,660.

France.—The French Post and Telegraph authorities in Paris have just placed a contract with Messrs. Geoffroy & Delore, of Clichy, Seine, for the supply of 100 km. of rubber and fireproof cotton-covered copper cables.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. John Brown & Co., Ltd., for 40 steel tires for tramcars, at 34s. each.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Auto-converters.—Crompton & Co., Ltd.
Electric cable and wire.—Siemens Bros. & Co., Ltd.
Engines and dynamos.—L. Gardner & Sons, Ltd.
Telephones.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Spagnoletti, Ltd.; West London Scientific Apparatus Co., Ltd.
Installation of electric light, right wing of Duke of York's headquarters, Chelsea.—W. G. Heath & Co.

GENERAL POST OFFICE.

Baudot apparatus.—Elliott Bros.
Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephonic apparatus, flexible cords.—London Electric Wire Co. and Smiths, Ltd.; British Insulated and Helsby Cables, Ltd.
Indicators.—Phœnix Telephone and Electric Works, Ltd.
Jacks.—Western Electric Co., Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Aerial cable.—Johnson & Phillips, Ltd.
Paper-core cable.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
S. and C.C. cable.—Western Electric Co., Ltd.; British Insulated and Helsby Cables, Ltd.
Submarine cable.—Henley's Telegraph Works Co., Ltd.
Desiccators.—Lacy-Hulbert & Co., Ltd.
Electric light fittings.—General Electric Co., Ltd.
Bronze wire.—British Insulated and Helsby Cables, Ltd.; T. Bolton and Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.
Telephone exchange equipment, Sale, Manchester.—Peel Conner Telephone Works, Ltd.
Ditto, Uxbridge.—Western Electric Co. Ltd.

Hornsey.—The B.C. has accepted the tender of the Bastian Meter Co., Ltd., for the supply of 5-ampere meters, and that of Messrs. Venner & Co. for C. & H. meters, for the coming year. The B.C. has also accepted the tender of the Reason Manufacturing Co., Ltd., for electrolytic meters for the year. Messrs. Venner & Co. have also received contracts from Worcester and Halifax.

Keighley.—The Keighley and Bingley Joint Hospital Board has accepted the tender of Mr. Hugh Spencer for electrician's work at the hospital.

London.—L.C.C.—The Highways Committee has this week issued a list of tenders accepted for the supply of tramway parts, equipment, &c., for 12 months :—

Motor and generator spares.—British Westinghouse Co. and Dick, Kerr and Co., Ltd.
Controller, circuit-breaker and other switch, &c., details, and magnetic brake spares.—British Westinghouse Co.; Dick, Kerr & Co.; and Brecknell, Munro & Rogers.
Contact fingers and parts, segments.—British Westinghouse Co.; Dyer and Young; E. Showell & Sons, Ltd.; and United Brass Founders and Engineers, Ltd.
Pressed brass and steel articles.—British Westinghouse Co. and M. Mole and Son.
Electric cable, fuse wire and cotton-covered copper wire.—British Insulated and Helsby Cables; General Electric Co.; London Electric Wire Co. and Smiths, Ltd.; and Siemens Bros. & Co., Ltd.
Copper bonds.—R. R. Todd.
Rubber details.—I.R., G.P. and T. Works Co.; J. G. Ingram & Son; Midland Rubber Co.; and North British Rubber Co.
Moulded insulators (other than rubber).—British Westinghouse Co.; British Isola and Micanite Co.; Crystalate Manufacturing Co.; and Ebonestos Manufacturing Co.
Fibre articles.—J. Burns, Ltd.; A. Cort & Co.; and Mosses & Mitchell.
Mica and micanite articles.—Micanite and Insulators Co. and G. Schultz and Co.
Track insulators.—Bullers, Ltd., and Doulton & Co., Ltd.
Car furniture.—Brush Co.; G. D. Peters & Co.; Player & Mitchell; and E. Showell & Sons.
Machined bronzed bearings.—Anti-Attrition Metal Co.
Machine-finished articles (brass, gun-metal, &c.).—Anti-Attrition Metal Co.; Brecknell, Munro & Rogers; British Westinghouse Co.; Bryant, Symons & Co.; Davis & Timmins; Player & Mitchell; and E. Showell and Sons.
Machine-finished articles (iron, steel, &c.).—Bayliss, Jones & Bayliss; Brecknell, Munro & Rogers; British Westinghouse Co.; Burton, Delingpole & Co.; F. W. Cotterill, Ltd.; Davis & Timmins; J. Holroyd and Co.; Horton & Son; F. W. Rowlands & Co.; and Wilkes, Ltd.
Gear and pinion wheels, rachets, worms.—British Hele-Shaw Patent Clutch Co.; J. Holroyd & Co.; and F. W. Rowlands & Co.
Iron and steel drop forged stampings.—Armstrong, Stevens & Son; Charles Bunn, Ltd.; Low Moor Co.; Smethwick Stamping Co.; Vaughan Bros.; Wilkes, Ltd.; and Woodall & Co.
Iron and steel forgings.—Bayliss, Jones & Bayliss; Brush Electrical Engineering Co.; Charles Bunn; East Ferry Road Engineering Works Co.; Hunter & English; Hurst, Nelson & Co.; Low Moor Co.; Male and Jordan; United Electric Car Co.; Warren & Sons; and Woodall and Co.
Springs.—Lion Spring Co.; Smith Bros. & Hill; Steel & Sons; and West Bromwich Spring Co.
Machined iron castings.—J. Holroyd & Co.; H. Newton Knights & Co.; J. Crowley & Co.; T. Summerson & Sons; Carron Co.; and P. Hooker.
Special iron castings.—Brightside Foundry and Engineering Co.; S. Griffith; Rodney Foundry Co.; T. Smith & Co.; and Wilsons, Pease & Co.
Machined malleable iron castings.—Brecknell, Munro & Rogers; Bullers, Ltd.; and Leys Malleable Castings Co.
Malleable iron castings.—Bullers, Ltd.
Steel castings.—E. Allen & Co.; Hadfield's Steel Foundry Co.; National Steel Foundry, Ltd.; and S. Peace & Sons.

The Highways Committee has ordered 5,800 coin testers for use in tramcars from Messrs. Hurst, Nelson & Co., for £74.

The Asylums Committee has accepted tenders from the following firms :—

Electrical sundries.—Siemens Bros. & Co.; General Electric Co.; Siemens Bros. Dynamo Works; Veritys; Edison & Swan Co.; B.T.H. Co.; Falk, Stadelmann & Co.; Cox Walkers; G. MacLellan & Co.
Electric lamps.—B.T.H. Co. and Edison & Swan Co.

Fulham.—The Electricity Committee has accepted the tender of W. T. Henley's Telegraph Works Co., at 5s. 3d. per yard run (the lowest price submitted) for cables (3,500 yd.) required for the supply to Earl's Court Exhibition. The British Electric Transformer Co., Ltd., are to supply ten transformers for the same service at £50 5s. each. In the list of tenders accepted for stores for the department for the year the following appear :—

Electrical goods.—Siemens Bros.; India-Rubber and Gutta-Percha Co., Ltd.; Pluste Scheele & Co., Ltd.; W. T. Henley's T.W., Ltd.; G. MacLellan & Co.; London Commercial Electrical Stores; British Westinghouse Co.; British Electric and Manufacturing Co.; British Insulated and Helsby Cables, Ltd.
Frames and covers.—W. T. Henley's Telegraph Works, Ltd.
House cut-outs and service boxes.—W. T. Henley's Telegraph Works, Ltd.; British Insulated and Helsby Cables, Ltd.
Carbons.—The Electrical Co., Ltd.
Glass globes.—Carl Quitman.

Shoreditch.—The Lighting Committee has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for lead-covered paper-insulated service cable as follows :—One mile ·035 cable at £80 per mile; 1½ miles ·022 cable, at £63 per mile.

Bermondsey.—The B.C. has placed contracts for annual supplies with the following firms :—

Morgan Crucible Co.—Dynamo and motor brushes.
T. Wragg & Sons, Ltd.—Conduits.
Siemens Bros. & Co., Ltd.—Conduits.
E. H. Cripps.—Meter boards.
Sykes & Sugden.—Street frames and covers, &c.
B.I. and Helsby cables.—Joint and disconnecting boxes, &c.

Marylebone.—The B.C. has accepted the tender of Messrs. Crompton & Co., at £1,160 (less 2½ per cent.), for a supply of converting plant.

Southampton.—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., for the supply of 170 tons of 7-in. tramway rails in 45-ft. lengths, at £7 5s. per ton, and 15s. per ton extra for 60-ft. lengths.

Waterloo.—The U.D.C. has accepted the tender of the Liverpool District Lighting Co., Ltd., for laying a service line to the Bowersdale Park Reading Room, and fixing meter, board and accessories.

Whitehaven.—The T.C. has accepted the following tenders :—

Metallic-filament electric lamps.—Falk, Stadelmann & Co., Ltd., and D. Burns & Co.
Electricity meters.—Ferranti, Ltd., and the Bastian Meter Co., Ltd.
Fuse boxes.—British Insulated and Helsby Cables, Ltd.
Dynamo spindle oil.—A. Duckham & Co., Ltd.
Bitumen.—Dussek Bitumen Co.
Tapes.—W. T. Henley's Telegraph Works Co., Ltd.

FORTHCOMING EVENTS.

Physical Society.—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A 2,000-Frequency Alternator," by Mr. W. Duddell; "A New Method of Comparing Capacities," by Mr. A. Campbell; and "The Coefficients of Cubical Expansion of Fused Silica and Mercury," by Mr. H. Donaldson.

Electro-Harmonic Society.—Friday, March 22nd. At 8 p.m. At the Holborn Restaurant. Last smoking concert of the season.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 22nd. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-upon-Tyne. Further discussion on Mr. A. H. Finch's paper on "Some Considerations on the Choice of Auxiliary Plant for Power Stations."

Association of Engineers-in-Charge.—Saturday, March 23rd. At 6.30 p.m. At the Holborn Restaurant. Annual dinner.

Royal Institution.—Saturday, March 23rd.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture V.)
Friday, March 29th. At 9 p.m. Discourse on "Results of the Application of Positive Rays to the Study of Chemical Problems," by Prof. Sir J. J. Thomson.
Saturday, March 30th. At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture VI.)

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, March 26th. At 7.30 p.m. At the University, Manchester. Paper on "Rail Corrugation," by Prof. A. Schwartz and Mr. R. G. Cunliffe.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday March 27th. At 7.30 p.m. At the Grand Hotel, Birmingham. Papers on "Some General Principles involved in the Electric Driving of Rolling Mills," by Mr. C. A. Ablett.

Institution of Electrical Engineers (London).—Thursday, March 28th. At 8 p.m. Paper on "The Power Factor and Conductivity of Dielectrics when Tested with Alternating Electric Currents of Telephonic Frequency at Various Temperatures," by Dr. J. A. Fleming and Mr. G. B. Dyke.

Junior Institution of Engineers.—Friday, March 29th. At 8 p.m. At the Criterion Restaurant, Piccadilly Circus. Smoking concert.

Smoke Abatement Exhibition.—Saturday, March 23rd and daily to April 4th, inclusive. At the Royal Agricultural Hall, London. Opening ceremony by Sir W. Richmond on Saturday at 12.30 p.m.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, March 25th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Tuesday, March 26th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.
Thursday, March 28th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Friday, March 29th.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m. Recruits' instruction, 7 to 9 p.m.
Saturday, March 30th.—Easter Camp at Dover. Party will parade at headquarters for the issue of arms, etc., at 12.30 p.m. Kit bags and necessaries for Camp to be packed and properly labelled with owner's regimental number, name and destination on the outside of same, and to be brought to headquarters before the time ordered for the parade.

(Signed) P. H. S. Campbell, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

Radium in Hot Springs at Bath.—Investigations which have been carried on by Sir W. Ramsay show that appreciable quantities of radium are present in the Bath mineral waters, and that niton, the emanation from radium, is present in large amounts compared with the Buxton waters. As niton is always being given off from the surface of the waters, patients taking baths inhale it, and probably some is absorbed by way of the skin. The latter process can be accelerated, Sir William Ramsay believes, by connecting the bather with the negative pole of a battery at 100 volts or more, the positive pole being connected to the water; the niton being positively charged by its discharge of electrons will then be attracted to the body and be quickly absorbed. Similarly the administration of stronger doses could be effected by the use of a spraying machine, fed with the natural gas under pressure; the gas being strongly charged with niton, its effect should be 20 times as great as that of the water as at present used.

NOTES.

Electric Heating and Cooking.—We have received the following letter from Mr. Percy Good :—

"I have received from Mr. Meares a courteous reply to my letter which appeared in your journal. He contends that the public do not know of the things I talked about.

"This, Sir, is neither your fault nor mine. I devised a simple and very cheap system for the satisfactory solution of the hot-water problem. I used it for 12 months and described it fully, and you were courteous enough to give it full publicity—in fact, you paid for the opportunity. There is no patent or registration about the apparatus. What more could you do? (The article appeared March 17th, 1911.)

"I saw one leading London supply company soon afterwards, and they said they would write to me again, but I heard no more. Having my bread and butter to earn, could I be expected to do any more?

"Percy Good.

"London, S.E., *March 11th*, 1912."

"Northampton" Past Students.—The Association of Past Day Students of the Northampton Institute is just completing the fourth year of its existence; it is claimed that no other Old Students' society can boast keener members, and it may soon be also affirmed that none can show a longer membership roll. A Bohemian concert is being held under the auspices of the Association on Friday, March 29th, as a wind-up to a most successful season, and it is hoped that all old "Northampton" students, with their friends, will make an effort to be present. The function will be held at the Food Reform Restaurant, Furnival Street, Holborn, at 7.30 p.m., and ladies are specially invited. Tickets (1s. 6d. each) can be obtained from the hon. secretary, Mr. J. C. Rennie, 28, Oxford Road, Putney.

Publicity Literature.—We have received from the Electric Supply Publicity Committee a further batch of its publications, dealing particularly with electric cooking. These include a small illustrated pamphlet and cards, some with monthly calendars on them, suitable for enclosure with letters, accounts, &c. A leaflet referring to the use of electric fans, and the benefit of keeping the air in workrooms in motion, is also enclosed. The Committee is issuing a larger booklet embodying a number of lectures by Mrs. Cross, 1st Class Diplomée, National Training School of Cookery, and freely illustrated with line drawings, which will, no doubt, be appreciated by those who have adopted electric coooking.

Electro-Harmonic Society.—The last smoking concert of the season will be held to-night at 8 o'clock at the Holborn Restaurant (King's Hall). Mr. Philip Dawson will be in the chair. The artistes are as follows:—Vocalists, Mr. Charles Saunders (tenor), Mr. Peter Dawson (baritone). Solo clarinet, Mr. Charles Draper. Conjurer and juggler, Mr. Stanley Collins. Scotch versatile comedian, Mr. Jock Walker. Humorists, Mr. Fred Wildon and Mr. James Campbell. Character entertainer, Mr. Thornley-Dodge. Sketch at piano, Mr. Ernest Hastings. Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Electrical Trades Benevolent Institution.—The annual general meeting of this Institution will be held at the Institution of Electrical Engineers, Victoria Embankment, London, W.C., on Wednesday, March 27th, at 2.30 p.m. The meeting will receive the report of the committee and the accounts for the year 1911, after which it will proceed to consider and, if approved, pass the alterations which have been made to the rules of the Institution, and to fix the date of the general meeting to confirm them. The following members of the committee of management retire by rotation, and are eligible for re-election: Messrs. H. H. Berry, H. Bevis, Guy Burney, E. J. Clark, Sir J. Irving Courtenay, W. Davenport, B. Longbottom, and S. D. White. The meeting will also elect auditors in accordance with Rule 16. We understand that the new rules which are to be submitted contain alterations of an important character, inasmuch as they create a membership. Anyone who is qualified under the usual definition of the Institution will be able, if these rules are passed, to become a member on payment of a minimum subscription of 10s. per annum. Such subscription can be paid in instalments. The main object of this alteration is to bring in the rank and file of the staffs of the electrical industry. Various details, such as arrangements for collectors, &c., are also covered by the rules, which thus place the Institution on a broader basis. There are, of course, many electrical firms which are not large enough to have sick funds of their own, and it is to the members of the staffs of such as these that this new scheme will specially appeal.

Cable Suspension in a Coal Mine.—A colliery electrician writes to say that he is about to put down the pit a two-core 19/16 cable, double armoured, 1,000 yards long. It has to be suspended from end to end along a level which is fairly wet, and wooded all the way both sides and roof. Information regarding the best means of suspending the cable from roof or sides will be greatly appreciated by him.

International Congress of Applied Chemistry.—We have received Announcement No. 3 of this Congress, which is to be held at Washington and New York, September 4th to 13th, 1912. Early application should be made by those who propose to attend it.

Smoke Abatement Exhibition.—This exhibition will be opened to-morrow, at 12.30 p.m., at the Agricultural Hall, Islington. The Electric Supply Publicity Committee and the B.E.A.M.A. have combined to make an electric show in the King Edward's Hall, the principal part of which will be an electric restaurant, where full-course meals will be served, cooked in full view of the visitors; ordinary refreshments will also be supplied. Expert cooks are being obtained from the National Training School of Cookery, and the London Home Delicacies Association have been retained as caterers for the restaurant. Everything in the restaurant will, of course, be electrical. There will be an electric vacuum-cleaning exhibit, an electric laundry and electric heating. The Electric Supply Publicity Committee will have an information bureau at the entrance from the main hall. The Russian Balalaika Orchestra, under the direction of Prince Tschagadaeff, has been retained by arrangement with Mr. Clifford Essex. The exceptional interest in this Exhibition which is manifested by the electrical trades may be appreciated from the following list of exhibitors:—

Sun Electrical Co.—Electric signs, hair dryers and oven.
Mabbott & Co.—Vegetable peeling and paring machines, knife cleaners, plate washers.
Dowsing.—Radiators, solarium bath, vibrators.
Purcell & Nobbs.—Radiators, heaters, foot warmers, humidifier, wall and window heaters, cookers, carving table, hot cupboard, coffee percolator, fish fryer.
Causton.—Moving signs.
B. T.-H. Co.—Radiators.
Ferranti, Ltd.—Electric fires, cooking outfits, grills and utensils.
General Electric Co., Ltd.—Radiators and heating apparatus, ovens, urns, kettles, cooking utensils, cigar lighters, glue pot.
Edison & Swan United E. L. Co.—Radiators and heating apparatus.
Drake & Gorham.—Heaters.
Berry, Skinner & Co.—Heaters.
Siemens Bros.—Irons, convectors and radiators.
Electric and Ordnance Accessories, Ltd.—Heaters, cookers, urns, &c.
City of London E. L. Co.—"Bankside" water heater.
Adnil Co.—Fans.
Berry Co. ("Tricity").—Cooker, hot plates, utensils.
Benson.—Plate warmer.
Jacksons.—Cookers and utensils.
Mavor & Coulson.—Vacuum cleaner.
Armorduct Co.—Vacuum cleaner.
Metropolitan Electric Supply Co.—Towel dryers.
Spagnoletti.—"Therol" water heaters and accelerators.
Synchronome Clock Co.—Electric clock.
Bertram Thomas.—Cooker and utensils.

The following are among the papers which will be submitted for consideration by the Conferences :—

Dr. S. Rideal, D.Sc., F.I.C., "Effects of Town Air on Metal Work."
Mr. Ruston, B.Sc., of Leeds University, "An account of investigations into the effect of Smoke."
Dr. J. S. Owens, M.D., A.M.I.C.E., "Wasteful Power Production."
Dr. R. Lessing, Ph.D., F.C.S., "The Economic aspect of Smoke Abatement."
Bailie W. Smith, of Glasgow, "Smoke Abatement in Scotland."
Mr. J. B. C. Kershaw, F.I.C., F.S.S., "Notes on Recent Progress in the Campaign against Black Smoke in this country."
Mr. L. A. Willard (Boston), "Smoke Problem in the U.S.A."
Commander W. F. Caborne, C.B., R.N.R., "Stoking."
Mr. W. Nicholson (Chief Smoke Inspector for the City of Sheffield), "Smoke Abatement from the Inspector's Point of View."
Herr Ingenieur Nies (Chief Engineer, Hamburg Smoke Abatement Society), "Progress of the Smoke Abatement Movement in Germany."
Mr. W. D. Scott-Moncrieff, "Solid Smokeless Fuels."
Mr. Julian S. Corbett, LL.M., F.S.A., "Smoke Abatement Laws in Other Countries."
Principal Graham (President of the Smoke Abatement League), "The League's Proposed Smoke Abatement Bill."
Mr. Frank Bailey, M.I.C.E. (Engineer and Joint Managing Director, City of London Electric Lighting Co., Ltd.), lecture on "Electricity, Lighting, Heating and Power."

Walking Race.—We are informed that a large number of cyclists have offered their services as competitors' attendants for the Open London-to-Southend Amateur Walking Race on April 6th, and the Committee will now be able to provide each competitor with at least one cyclist attendant. Arrangements are being made for refreshments to be supplied gratis to competitors at certain points *en route*, whilst a motor-car may also follow the race to supply the wants of the walkers in this direction. In addition to three prizes for the scratch race and three for the sealed handicap, a special prize will be offered to the first man (not otherwise a prize winner) to finish who is engaged in the electrical trade, provided at least eight electrical trades employés start. There will be a stroll over the course on Sunday, March 24th, and all those who would care to join for the whole or part distance should communicate with the race hon. secretary, Mr. A. R. Edwards, 303, Amhurst Road, London, N. A prospective Southend competitor desires to know if other Southend competitors would join in the provision of a motor-car to look after Southend competitors exclusively. The Committee still needs the loan of a couple of motor-cars to convey officials on the day of the race, and any gentlemen willing to lend the same would greatly oblige by communicating with the hon. sec. as above.

Fatalities.—The *Sydney Herald* reports an inquest upon Bernard Jones, who was killed on January 25th, whilst engaged in drilling rock in a tunnel for a new sewer at Long Bay. The deceased man's mate said it was his first experience with an electric drill, and no instructions were given him by the contractors. Witness was in front, cleaning out the back hole, when he heard the deceased utter two sharp cries. Looking round, he saw him hanging over the back of the machine, his feet resting on the wood, and his hand clutching the handle of the drilling instrument. He rushed to the switch to cut off the current, but was hurled back by the shock. He then attempted to pull the deceased off the board. He was thrown back, however, and could not release him. The whole place was in darkness; the candles used had been extinguished. Davies next made a dash for the bottom of the shaft, and succeeded in shutting off the current; deceased had then fallen clear of the machine. Four minutes at the most had elapsed between the time of the accident and his arrival back from the switch.

William Corin, chief electrical engineer in the Public Works Department, and consulting engineer to the Mines Department, stated that the machine was not strictly an electrical drill; it consisted of an electric motor, driving an air compressor. His theory was that the deceased had his right foot on the machine and his right hand on the handle of the drill; or the deceased might have received the current through a faulty controller. In either case, the current would pass through his body to his right hand, which would be "earthed." The machine was not properly earthed. At present no regulation insists upon the earthing of portable motors. There should be such a regulation introduced. He thought there was a lack of knowledge apparent at Long Bay, and a want of the appreciation of danger.

The Coroner delivered a verdict of death from the effects of shock, accidentally received by the deceased while working with a rock drill, the driving motor of which was not properly earthed. In view of the evidence on the case, he added, it seemed of vital necessity that all persons engaged in any such work should, on engagement, receive electrical instruction.

The same paper, of February 1st, contains a report of an inquest on the death of Basil Wood, who was killed in the boiler-room of a timber yard at Pyrmont.

P. J. Day stated that deceased was cleaning the boilers, and was using a flexible portable extension electric light, which had been in use in the works from November 18th of last year. MacFarlane, the other fireman, attached the lamp and used it for about half an hour before handing it to witness, who used it for some time before giving it to MacFarlane again. Wood finished the boilers and asked MacFarlane to hand him the lamp. MacFarlane did so, and immediately deceased took the lamp he cried out and fell. Witness and MacFarlane ran to the switches to turn off the current. When deceased took hold the wire of the lamp, it was wet, and he was standing on a wet iron plate.

William Corin, electrical engineer to the Department of Public Works, stated that the lamp in question was attached to a switch-panel, which he could not examine with safety. He examined the cord (produced), and found the rubber insulator to be of medium quality, such as would give fair service if used for a simple pendant light in a position where it would not be liable to abrasion, and where the atmosphere was normally dry; the class of cord, however, would be quite unsuitable for use in any position where moisture would be frequently present, as in a boiler house. He made a test of the insulation, and found that, to say the least, it was low, and when the wire was damp, very low. It would be possible for the deceased to get a shock while holding the cord. In Sydney it was not the custom to earth the extension lights, but in England it was, and he thought that the Department of Trades and Labour should pass a similar regulation.

The Coroner returned a verdict of "Accidental death."

An inquiry was held on the 12th inst. at Walker-on-Tyne into an unusual fatality that had occurred on the previous day at Messrs. Dobson's shipyard. The victim was a youth named Harold Doughty (16). The evidence was to the effect that as Doughty and a lad named Hatcliffe were playing football with an orange, the orange was kicked over the wall, and Doughty climbed over the wall after it. While Doughty was creeping along on his hands and knees, he fell over, and a little later was heard shouting out. Doughty's companion got on to the wall and saw Doughty lying on the roof of a shed as if he were dead. The affair was reported at the yard, but when Doughty was reached he was dead. William Maidman, an electrician at Messrs. Dobson's shipyard, said that 3 ft. from the top of the wall there were wires which carried 440-volt electric current to the machinery in that part of the yard. When the accident was reported he cut the current off and went to the shed on to the top of which Doughty had fallen. The latter had come into contact with the live wires. In answer to the Coroner, witness said that it was customary for exposed wires to be used in some shipyards because they carried a higher voltage than insulated ones. There was no notice up, but it was intended to post them both inside and outside the yard. A verdict that deceased had been accidently killed was returned.

Social Events.—The annual staff ball of Messrs. Bruce Peebles & Co., Ltd., was held at the North British Station Hotel, Edinburgh, on Friday last. About 200 ladies and gentlemen were present, including a number of the directors, branch managers, and agents of the firm with their wives, and the event was very successful. A reception by the general manager and his wife (Mr. and Mrs. Lee Murray) preceded the first portion of the dancing programme. Supper followed, after which the remainder of the dancing programme was carried through with zest. At the supper, which was laid in the large supper room of the hotel, the tables were beautifully decorated with red and yellow flowers, the colours of the firm. The general manager presided in his usual genial way, and after proposing the toast of "The King," called on the Works Manager (Mr. W. A. Scott) to propose the firm. This toast was responded to by Mr. A. W. Tait, C.A. (director). The toast of "Our Guests" was proposed by Mr. A. B. Anderson (director), and responded to by Mr. James Watt, W.S. Indicative of the good feeling existing between the management and the staff, was the enthusiasm with which the toast of "The Chairman" was received. Reference was made to the results achieved by the firm in 1911, and the optimism was expressed by all the speakers.

The Perth Corporation Tramway employés held their annual social gathering last Friday evening, when Councillor Moncrief presided. An enjoyable dance followed the musical programme.

Electric Smelting of Iron.—Trials made from September 3rd to 9th last, at Trollhattan, with the electric manufacture of iron gave the following results:—

Consumption of ore, in tons	192·5
„ „ lime „	7·7
„ „ charcoal „	44·2
„ „ energy, KW.-hours	226,000
Average load, KW.	1,357
Iron produced, in tons...	131·4
Slags „	22·1
Charcoal per ton of iron, in kg.	336
Iron, per KW. and per year, in tons	5·5
Iron, per H.P. „ „ „	3·79
KW.-hours per ton of iron	1,736

At the end of 1911 there were in working in Scandinavia four similar furnaces—one of 1,500 KW. at Domnarfvet, in Sweden; one of 2,000 KW. at Tyssan, in Denmark; and two of 2,000 and 2,200 KW. respectively, at Hagfors, in Sweden.—*Industrie Electrique.*

The *Board of Trade Journal* states with regard to the electric iron smelting works at Tinfos, in Telemarken, that work will be begun in May next with three blast furnaces and a reserve furnace, provided that a concession is granted in the near future for laying wires for conducting electricity at high pressure to the works.

Northampton Institute Dinner.—The tenth annual dinner of the Northampton Institute (Engineering) Day Students took place at 7.30 p.m. on Saturday, March 16th, 1912, at the Holborn Restaurant, Mr. E. L. M. Emtage in the chair. After the toast of "His Majesty the King" had been duly honoured, an excellent musical programme was gone through. The events of the evening were, as usual, the topical song sung by Mr. Emtage and the distribution of the Eng. Soc. Premiums, for papers read during the past session, by Dr. Walmsley. The standard of papers read before the Society this session has been very high. Representatives of the Finsbury, University, and Central Technical Colleges were present. The function was in every way a record success.

The Mortier System of Telegraphing Pictures.—The Mortier system of telegraphic transmission of pictures requires no special electrical apparatus, and is capable of use in conjunction with any ordinary telegraph line. The picture to be transmitted is resolved into a number of tiny sections, the relative brightness of which is observed and telegraphed in a predetermined order and according to a predetermined code. According to instructions thus received, the picture is recomposed, at the receiving station, by "microtype."

Since the eye is incapable of estimating brightness differences with accuracy sufficient for the above purpose, the original is photographed through a special screen composed of ten transparent sheets, marked out in equal squares, but variously filled in with different geometrical patterns. The reproduction appears divided into a number of "fields," each containing a certain number of points and lines to which various brightness figures can be attached by observation. The prepared picture is mounted in a frame, over which the observing apparatus can be run to and fro. The eye piece of the latter allows about 20 of the "cells" (as Mortier calls the fields of the picture) to be observed at once, and the operator simply dictates, in a definite order, the various brightness figures of the picture. On receipt of the code message, which may be variously arranged to lessen the cost of transmission, the picture is set up with microtype, the thickness of the lines and the size of the dots of which reproduce the desired apparent brightness of the various parts of the picture.

At first sight the process appears crude, but the results attainable by its use are said to be very satisfactory, and certainly the simplicity of the apparatus required is a great point in its favour. Working with six degrees of brightness, results quite good enough for newspaper and similar work can be obtained. An average small picture is divided into about 3,900 points, and the brightness data are transmitted by 880 pairs of figures which may, for cheapness, be sent as 440 words. The preparation of the original, the transmission of the brightness figures, and the setting up of the microtype for such a picture may occupy about ½ hour each—1½ hours in all. Under the most unfavourable conditions, it is possible to have a block ready for printing within two or three hours after taking the original photograph at any place within reasonably direct telegraphic communication.

Electric Stamp-Cancelling.—The German Postal Department are making use of an electric apparatus to cancel the stamps on letters, &c. The letters are made up into packets and a little india-rubber wheel carries them one by one under the apparatus. With letters of the same size, 900 cancels per minute

are done; uniform sized postcards are cancelled at the rate of 1,000 per minute; and those of various sizes at 600 per minute. By hand, an expert operator can only do this work at the rate of 100 per minute. Hardly 1 per cent. of the letters are missed, and at most 5 per cent. when the objects are of different sizes. The apparatus is driven by a motor of a capacity of ¼ or ½ K.W.—*E.T.Z.*

Appointments Vacant.—Junior assistant engineers, for the Yorkshire Electrical Power Co. (15s.); meter reader, tester, and fixer, for the Stoke-on-Trent Borough Electricity Department (27s. 6d.); two switchboard attendants (25s.), also a cable jointer (30s.), for the Dundalk U.D.C.; junior assistant engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd. See our advertisement pages to-day.

National Physical Laboratory.—On Friday last the annual inspection of the Laboratory took place, and the Report for the year 1911 was issued. The Executive Committee, in presenting the latter, express their sympathy with the Director, Dr. Glazebrook, who is now recovering from his very severe illness, and record their high appreciation of the energy and devotion which he has given to the service of the Laboratory. During the year the new Metallurgy building, provided through the generosity of Sir Julius Wernher, was completed and occupied, and the contract for the Administration and Optics buildings was let. The Froude Tank was opened by Lord Rayleigh, and was brought into use. Progress was made with the Lorenz apparatus and the international specification for the silver voltameter, 13 new mercury standards of resistance were constructed, and the work on mutual inductance was advanced. Tests of total energy and hysteresis loss in iron sheet were made, and the establishment of sets of sub-standards for the photometry of electric glow lamps, experiments on induction meters, researches on insulating materials, and tests on dry cells, &c., were conducted, besides many other investigations less intimately associated with the electrical industry. The electrical measurements made in the Physics Department showed a considerable increase, from 172 to 269. The bulk of the increase was in connection with hysteresis and eddy-current measurements, which together numbered 109. Electrotechnical measurements rose to 2,203, as against 1,810 in 1910 (but 2,328 in 1909); a steady increase took place each year in the tests of resistance coils, ammeters and voltmeters, but supply meters fell off in numbers. Dielectric strength tests jumped up from 86 to 252, while fuses fell from 777 in 1909 to 21 in 1910, and nil in 1911. Primary cells also were 200 in 1909, 93 in 1910, and 78 in 1911. Evidently these matters are controlled by wide-spreading influences. In photometry, the tests of glow lamps, which had fallen from 895 in 1909, to 440 in 1910, rose again to 886, the total number of tests of all kinds being 920.

The income of the laboratory rose from £28,077 in 1910, to £30,337 in 1911, mainly due to increased receipts for work done (from £15,363 to £17,398). The total expenditure for the year was £30,572, or £235 more than the receipts.

We shall deal with the technical features of the report more fully in a later issue.

The Strike.—The Electrical Apparatus Co., Ltd, ask us to state that they have not been in any way inconvenienced by the coal strike.

The Electric Driving of Textile Machinery.—The *Indian Textile Journal* recently contained an interesting article on the irregular driving of cotton machinery, and the marked advantages resulting from the individual electric drive. The trouble is attributed to the variations in the torsion angle of shafts, and to the use of inferior leather belting, which is said to be a common fault in Indian mills. Data are quoted from Lancashire practice showing that the electric individual drive increased the output of looms by 10 per cent. above that of looms driven from shafting, in spite of the fact that the latter was electrically driven. There is also a saving of 10 per cent. in power, and various other economies.

Institution and Lecture Notes.—Birmingham Association of Mechanical Engineers.—A paper on "The Application of Electricity to Industrial Purposes" was read by Messrs. F. J. Moffett and N. B. Rosher on March 14th. The authors stated that for the manufacture of nitrates from the air, carried on chiefly in Norway, the power installed approximated to 180,000 H.P., and was expected to rise to 300,000 H.P. in the next few years. In the manufacture of calcium carbide 60,000 H.P. was already employed. Much had been done to utilise waste gases on the North-East Coast, where the available surplus power had been estimated at 61,000 H.P. continuously; but very little had been done in the South Staffordshire and Worcestershire districts, where 21,000 H.P. was available. In dealing with rolling mills, it was stated that 80,000 to 90,000 H.P. was now used in the electrical driving of continuous and reversing mills in this country. Electric furnaces and their applications were described, and interesting curves were given of the cost of combustion and electric heat; in the case of the former the cost for low temperatures was quite small, but as the temperature rose the cost rose much more rapidly, until a point was reached at which no increase in expenditure could produce any increase in temperature, the reason being that the volume of gases in the blast became so great that the gases carried off the heat as quickly as the fuel supplied it. The maximum temperature for combustion heat was 1,500°-1,900° C., and for the electric arc furnace 3,500°-4,000° C. The cost of hardening 100 millers, each weighing 12 lb., was given as being £2 18s. 11d. with a gas furnace and gas at 1s. 6d. per 1,000 cb. ft., as against £1 8s. 6d. with an electric furnace and energy at 1·2d. per unit.

Mr. C. D. Taite read a paper before the Manchester Geological and Mining Society on Tuesday, upon "The Lancashire Electric Power Co.'s System, and Its Application to Lancashire Collieries." The aggregate horse-power supplied to collieries in Lancashire by the company, he said, was at present about 3,000 H.P., and this would shortly be increased to about 4,000. The present annual consumption by these collieries was about 4,000,000 units. For some reason Lancashire had been slower to adopt electrical methods than other colliery districts. In the Newcastle district electrical energy at the rate of 55,000,000 units per annum was being supplied for colliery purposes; in South Wales 12,500 H.P. was being taken, and a further 3,500 H.P. was contracted for; in the Clyde Valley district, 8,500 H.P. was connected or contracted for; and in Yorkshire 6,000 H.P. was at present connected or contracted for. There could be no doubt that where coal was most difficult to win, the most modern methods of working were essential in order that the cost of dealing with the coal might be kept at the lowest possible figure.

Institution of Electrical Engineers (Students' Section).—On Saturday last the eighth annual dinner of the Students' Section was held at the Trocadero Restaurant; Mr. E. F. Hetherington was in the chair, and there was a fair attendance of members and guests. After the toast of "The King," Mr. D. Betts proposed the health of "The Institution and the Hon. Treasurer"; he regretted that Mr. Ferranti had been prevented from attending, but took the opportunity of urging the question of "abstracts" upon the attention of the treasurer. Mr. R. Hammond, in the course of his reply, pointed out the valuable achievements of electrical engineering as evidenced during the present strike, and the importance of economising coal by generating power on a large scale at a central station. He then, in the absence of Mr. W. M. Mordey, proposed "The Students' Section," which he said numbered over 1,200; he drew attention to the great advantages derived by the Students from their connection with the Institution, at a very small cost. Mr. Hetherington, in reply, said that good progress had been made since last year, and emphasised the benefits to be derived from attending the meetings, preparing papers, and taking part in the discussions. They still hoped, he said, that the Institution would consent to have abstracts of the Students' papers printed for circulation before the meetings. They were also anxious for information regarding future policy in connection with the proposed examinations. He hoped that greater solidarity would be brought about between the London and provincial students.

Mr. E. W. Moss proposed "The Colleges," and remarked that whereas the Students' Section was formerly practically run by the colleges, the latter now did not take so active a part in their affairs as could be wished. With regard to the new Articles, he could not see what was to become of men over 23 and under 25 years of age, if the class of Licentiate was not established; and he pointed out that students who obtained their technical training by means of scholarships were not able to maintain themselves during works training—could not the Institution afford assistance to such men? In reply, Mr. Hammond urged the Students never to take anything for granted, but to master every point their teachers placed before them.

Proposing "The Guests," Mr. J. B. Sparks expressed the indebtedness of the Students to the Secretary of the Institution, Mr. P. F. Rowell, and to Mr. Tree; and the Chairman of the Graduates' Association of the Institution of Mechanical Engineers acknowledged the toast. An excellent programme was provided for the entertainment of the diners by Mr. Nadaud, and the function proved very enjoyable.

On Thursday, last week, at the Institution of Electrical Engineers, a lantern lecture was delivered by Mr. T. Stevens, who took as his subject an avalanche which occurred on the Wellington (U.S.A.) tunnel electric railway. The tunnel in question runs through a peak of the Cascade Mountains, and is operated by the Great Northern Railway, on the three-phase system, being the only three-phase railway electrification in the States. According to the lecturer the annual snow fall in the neighbourhood varies from 25 ft. to 75 ft., and up to 20 ft. of snow is found on the level. The speaker described one of a series of snow slides, which swept an accumulation of rolling stock which was snowed up in the Wellington yard, and the overhead trolley lines, &c., into the valley below the railway. Some two months elapsed before the electrical equipment was repaired. Indeed, it required 300 men and 28 snow ploughs working two days to open up ½ mile of track, the snow, to the depth of 30 ft., being first loosened by blowing it up with gunpowder. Needless to add, some unique lantern slides were shown, illustrating conditions which even a Highland railway official might envy.

Institution of Civil Engineers (Students' Meeting).—At the Students' meeting held on March 15th, a paper was read by Mr. A. E. Gladwyn, Student Inst.C.E., on "The Heat Value of Fuels."

Royal Institution.—The following arrangements are announced:—April 19th.—At 9 p.m. Mr. A. A. C. Swinton, on "Electricity Supply: Past, Present and Future."

May 17th.—At 9 p.m. Mr. W. Duddell, F.R.S., on "High Frequency Currents."

April 18th and 25th.—At 3 p.m. Prof. A. W. Crossley, F.R.S., on "Synthetic Ammonia and Nitric Acid from the Atmosphere."

May 30th and June 6th.—At 3 p.m. Prof. J. H. Poynting, F.R.S., on "The Pressure of Waves."

At the University College, Nottingham, on Friday last, Mr. S. H. Piper, B.Sc., concluded a series of popular experimental lectures on electrons, radio-activity, and Röntgen rays.

Institution of Civil Engineers.—The 20th "James Forrest" Lecture will be delivered on April 19th by Mr. H. R. A. Mallock, F.R.S., his subject being "Aerial Flight."

On Tuesday a paper was read by Mr. Justus Eck before the Illuminating Engineers' Society on "The Illumination of Printing Works by Electricity," illustrated by a unique series of lantern slides from photographs taken at night in the works of the principal London papers and magazines.

Junior Institution of Engineers.—At a recent meeting a paper was read on the subject of "Railless Electric Traction," by Mr. Bertram D. Fox, B.A. On Wednesday, April 17th, Mr. E. Kilburn Scott will read a paper on "Dynamo Design."

Electricity in Cotton Mills.—Mr. S. J. A. Mills, a consulting electrical engineer of Blackburn, recently gave an address before the Blackburn Managers' Mutual Association on the subject of "Power for Mills and Workshops."

A lecture on the "Origin of Radium" was delivered at the Royal Institution on Saturday last by Mr. Frederick Soddy.

The Johannesburg Gas Plant Litigation.—Settlement.—According to the *Evening Standard* it was stated on Wednesday in the Court of Session, Edinburgh, that a settlement had been reached in the action by the Municipal Council of Johannesburg, Transvaal, against Messrs. D. Stewart (1902), Ltd., and Mr. William Beardmore, for the payment of sums amounting to over £400,000, in respect of the abandonment of contracts for the installation of gas and electrical plant at Johannesburg. Of the sums claimed, £115,134 was the amount in a bond by Mr. Beardmore and others for the performance of the contract by Messrs. Stewart. The litigation commenced in 1908, and passed through various preliminary stages, including an appeal to the House of Lords. In the terms of the settlement, the plaintiffs have accepted £100,000, and are allowed to keep the plant, each side to pay its own expenses.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The St. Helens electric power station staff have presented a suit case to Mr. F. J. Helsby on his appointment as chief clerk at the Wrexham electricity works.

Mr. W. H. Hartnell, mains superintendent at the Cheltenham electricity works, who is leaving for Canada, has been presented by the staff with a silver-mounted calabash pipe and case.

At Blackpool last week Mr. James Anderson, electrical engineer, was the recipient (at the Golden Ball Hotel, Poulton,) of a watch presented as a token of good fellowship and esteem from friends at Poulton on his departure for Winnipeg, where he has accepted an appointment as electrical engineer.

The Barnes Council have decided to grant an immediate increase of £25 to the salary of the electrical engineer, and subsequent biennial increases of £25 each until his salary reaches £600.

At a meeting of the Sunderland T.C. on 13th inst. on the recommendation of the Electricity and Lighting Committee, the salary of Mr. Wilfred Yorke, superintendent at the Hylton Road electricity works, was advanced from £200 to £225, to be further increased at the end of 12 months to £250 per annum.

Mr. C. F. W. Sedgwick has resigned his position in the Sunderland Corporation Electricity Department, having been appointed electrical engineer at Messrs. S. Pearson & Son's Oil Refinery, Mexico.

Mr. K. F. Bishop has been appointed shift engineer at Warrington, not Darlington, as stated in our last issue. We regret the mistake.

Tramway Officials.—At a meeting of the Sunderland T.C. on 13th inst., Mr. New moved the adoption of the report of the Tramways Committee recommending the advance of the salary of the tramways manager, Mr. A. R. Dayson, from £500 to £600 per annum by four annual increments of £25. He said that Mr. Dayson was appointed in 1904, at a salary of £400, and he had given complete satisfaction. The recommendation was adopted.

Mr. Chivers has been appointed to succeed Mr. Smith as manager of the Peterborough Tramway Co.

General.—His Majesty the King has appointed Sir J. J. Thomson, D.Sc., F.R.S., to the Order of Merit. We tender our hearty congratulations to the distinguished Cavendish Professor of Experimental Physics at Cambridge.

Mr. Harold Smith, of South Shore, Blackpool, has just returned from Canada to accept an offer from Messrs. Mather and Platt, of Park Works, Newton Heath, with whom he was originally apprenticed, and for whom he was superintendent of the electrical department for some time. While in Canada Mr. Smith was for 2½ years with the Montreal Light, Heat, and Power Co. (with a capital of 5½ millions), as superintendent of their repair and manufacturing shops. Later Mr. Smith accepted a more lucrative position as production engineer to the Canada Foundry Co., at Toronto, and he had been there a year when Messrs. Mather and Platt's invitation reached him.

Mr. Frederic H. Taylor, consulting engineer, has removed from 14, Victoria Street, to new offices at 19, Old Queen Street, Westminster. Telephone No. "Victoria 1,457."

NEW COMPANIES REGISTERED.

British Arc Welding Co. (Mersey), Ltd. (120,724).—This company was registered on March 8th, with a capital of £20,000 in £1 shares, to take over and work a process for electrical welding under a grant or licence given by the British Arc Welding Co., Ltd., to H. & C. Grayson, Ltd., under an agreement dated February 16th, 1912. The subscribers (with one share each) are:—T. G. McKay, 171, Hornby Road, Bootle, Liverpool, engineer; G. S. Johnson, 18, Chambres Road, Southport, engineer. Private company. The number of directors is not to be less than two or more than six; the first are to be appointed by the subscribers, subject to the right of the British Arc Welding Co., Ltd., to nominate one director; qualification, 200 shares; remuneration as fixed by the company. Registered by Walker, Son & Field, 61, Carey Street, W.C.

Collings-Bishop, Ltd. (120,674).—This company was registered on March 6th, with a capital of £5,000 in £1 shares (2,500 preference), to carry on the business of electricians, contractors, engineers, manufacturers of electrical apparatus, &c., and to adopt an agreement with H. C. Bishop. The subscribers (with 10 shares each) are:—P. H. P. Wells, 48, Belsize Square, Hampstead, N.W., gentleman; J. A. Hart, Blenheim, Eagle Road, Wembley, N.W., gentleman. Private company. The number of directors is not to be less than three or more than nine; the first are H. C. Bishop, P. H. P. Wells and J. A. Hart; holders of a majority of preference shares may appoint two directors, and holders of a majority of ordinary shares, one director; qualification, 10 shares. Registered office: 19, High Street, Cardiff.

Brompton and Kensington Accessories Co., Ltd. (120,670).—This company was registered on March 6th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, mechanical and electrical engineers and contractors, manufacturers of, and dealers in, electric supplies and accessories of all kinds, &c., and to adopt an agreement with the Brompton and Kensington Electricity Supply Co., Ltd. The subscribers (with one share each) are:—R. S. Downe, 254, Earl's Court Road, S.W., electrical engineer; T. J. Owens, 254, Earl's Court Road, S.W., secretary. Private company. The directors for the time being of the Brompton and Kensington Electricity Supply Co., Ltd., shall be the directors of this company. Registered by Linklater, Addison & Brown, 2, Bond Court, Walbrook, E.C.

Foreign Construction Syndicate, Ltd. (120,768).—Registered March 11th, with capital £10,000 in £1 shares, to carry on the business of constructors and workers of tramways, railways and public works, capitalists, financiers, promoters, concessionaires, &c. The subscribers (with one share each) are: R. C. Howley, 11, St. Anne's Road, Leytonstone, Essex, clerk; P. M. Cullen, Revidge, Blandford Road, St. Albans, clerk. Private company. Table "A" mainly applies. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Hallamshire Electric Co., Ltd. (120,873).—This company was registered on March 15th, with a capital of £2,000 in £1 shares, to carry on the business of electrical and mechanical engineers, suppliers of electricity, motive power and light, &c. The subscribers (with one share each) are:—H. D. B. How, 96, Banner Cross Road, Ecclesall, Sheffield, engineer; H. Clarke, 61, Meersbrook Road, Sheffield, traveller. Private company. The number of directors is not to be less than two or more than three; the first are H. D. B. How and H. Clarke; qualification, £100. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

S. Bill & Co., Ltd. (120,830).—This company was registered on March 13th, with a capital of £4,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electrical accessories, dealers in electrical articles and appliances, manufacturers of motor-car fittings, electrical cases and cabinets, stampers and piercers, &c. The subscribers (with one share each) are:—S. Bill, 162, Rolfe Street, Smethwick, Birmingham, manufacturer; J. Richards, Vicarage Road, Handsworth, Birmingham, manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are S. Bill, J. Richards and R. W. Bill; qualification, 200 shares. Registered office, 388, Park Road, Hockley, Birmingham.

Electric Lamp Regenerators, Ltd. (120,796).—Registered March 12th, by Romer & Skan, 4, Copthall Chambers, E.C. Capital £50,000 in £1 shares. Objects:—To carry on the business of manufacturers and repairers of, and dealers in, electric lamps, reflectors, lenses, and other articles, opticians, glass blowers, engineers, manufacturers of globes, films, shades, burners, meters, galvanometers, ammeters, voltmeters, carbons, switches, accumulators, motors, batteries, wires, insulators, &c., to acquire an invention relating to electric and other lamps or any lenses, reflectors, and component parts, together with Patent No. 16,280 of 1911, for an improved method of and apparatus for regenerating burnt-out carbon and metal-filament electric lamps; and to adopt an agreement with L. H. Keep. The signatories (with one share each) are:—P. H. Brashier, 45, Lessar Avenue, Clapham Common, S.W., gentleman; H. J. Sheppard, 20, Adamsville Road, Sydenham, clerk; F. Romer, 4, Copthall Chambers, E.C., solicitor; H. E. Skan, 7, Grittleton Road, Elgin Avenue, Maida Vale, W., clerk; A. H. Skan, 4, Copthall Chambers, E.C., solicitor; E. Edwards, 11, Halley Street, Limehouse, E., clerk; F. W. Beard, 32, Winchester Avenue, Brondesbury, N.W., secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are J. H. Keep, Abbots Langley, Herts.; W. A. Lageson, 17, Avenue Mansions, Hampstead, N.W.; and F. F. Albrecht, 8, Draper's Gardens, E.C.; qualification (except first directors) 500 shares; remuneration as fixed by the company. Registered office, Salisbury House, London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cantie Switch Co., Ltd.—Debenture dated February 23rd, 1912, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: E. G. Phillips, Heatherbrae, Woodborough Road, Nottingham; and W. F. Cox, Tavistock Chambers, Market Place, Nottingham.

Fletcher Jackson & Co., Ltd. (119,942).—Particulars of not more than £1,000 debentures, created February 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £800. Property charged: The company's undertaking and property present and future, including uncalled capital. No trustees.

Auxiliary Electrical Co., Ltd.—Return dated December 31st, 1910, filed March 29th, 1911. Capital, £70,000 in £5 shares. All shares taken up; 2 guineas called up on each share; £82,400 paid, in addition to £4,965 12s. 7d. received in anticipation of calls. Mortgages and charges: Nil.

Paignton Electric Light and Power Co., Ltd. (98,437).—Agreement for loan, dated December 29th, 1911, to secure £3,000, charged on company's assets. Holders: W. J. Ham and others, all of Paignton. (Registered March 4th, 1912, pursuant to Order of Court).

Nairobi Electric Power and Lighting Co., Ltd.—Issue on July 27th, 1910, of £800 debentures, part of a series of which particulars have already been filed. (Notified March 5th, 1912.).

Church Stretton Electric Supply Co., Ltd. (80,857).—Further charge on freehold hereditaments at Crossways, Church Stretton, and company's other assets, dated March 7th, 1912, to secure £100. Holder: E. Bond, 48, Thurloe Square, S.W.

Londonderry Moville Electric Railway Syndicate, Ltd. 75,455).—Return dated January 12th, filed January 19th, 1912. Capital £10,000 in £1 shares. 6,507 shares taken up. £1 per share called up on 1,507. £1,425 5s. paid, leaving £81 15s. in arrears. £5,000 considered as paid on 5,000 shares. Mortgages and charges: Nil.

Kent Electric Power Syndicate, Ltd. (72,742).—Return dated January 13th, 1912. Capital £15,000 in 1,500 ordinary shares of £10 and 600 deferred shares of 1s. each. All shares taken up. £10 per share called up on 1,500 ordinary and 1s. per share on 600 deferred. £15,022 19s. paid, leaving £7 1s. in arrears. Mortgages and charges: £1,089.

India-Rubber, Gutta-Percha, and Telegraph Works, Ltd. (1,122c).—Return dated January 2nd, 1912. Capital £812,000 in 50,000 ordinary and 25,000 preference shares of £10 each and £62,000 unissued capital; 50,000 preference and 25,000 ordinary shares taken up; £750,000 paid. Mortgages and charges: £400,000.

Rangoon Electric and Supply Co., Ltd.—A memorandum of satisfaction to the extent of £4,600 on February 20th, 1912, and to the extent of £977 on March 5th, 1912, of debenture stock dated February 1st, 1906, and December 22nd, 1908, securing £250,000, has been filed.

CITY NOTES.

Newcastle and District Electric Lighting Co., Ltd.

THE directors' report for 1911 states that the number of units sold during the year was 13,599,294, as against 12,234,106 sold in 1910, being an increase of 11·16 per cent. for the year. The result of the year's working is as follows:—Gross profit at Newcastle Works as per profit and loss account, £25,699; gross profit at Lemington and Newburn Works as per profit and loss account, £3,067; transfer fees, £5 = £28,771, plus balance brought forward (£4,807), making £33,578; less interest on debenture stock, temporary loans, &c., £13,363; directors', trustees', and auditors' fees, income-tax, leasehold redemption fund, &c., £1,920; and less interim dividend paid August 31st, 1911, £4,198, leaving an available balance of £14,097. The directors recommend a dividend at the rate of 3 per cent. per annum (less income-tax) for the half-year ended December 31st last, absorbing £4,199, and making with the interim dividend paid in August 3 per cent. for the year, leaving a balance of £9,898 to be carried forward, as against £4,807 brought forward from 1910. The improved results foreshadowed in the directors' report for 1910 have been realised during the past year, the profit having been considerably increased; but, owing to the present disturbed state of the labour market, the directors do not think it advisable to recommend an increase in the dividend. Favourable contracts for the supply of coal over the whole of this year have been made, and the directors have reason to anticipate a further increase of profit during the year. The company have arranged with the Corporation of Newcastle-upon-Tyne to supply for a period of 10 years from the date of their commencing to work, all the electrical energy required for the Newburn Tramways sanctioned by Act of Parliament last year, and at the end of that term negotiations may be entered into for a renewal of the contract. The efficiency and economy associated with the use of the metal-filament lamps has led to a large increase in the number of consumers, and as the applications for current show no sign of falling off, these high efficiency lamps should eventually prove a great advantage in the development of the company's business. As in previous years, the whole of the plant and machinery, together with buildings, &c., owned by the company have been maintained in a complete state of efficiency out of revenue during the year.

The meeting is called for March 28th.

Oxford Electric Co., Ltd.

SIR HENRY MANCE presided at the annual meeting, held on March 8th, and in moving the adoption of the report (see ELECTRICAL REVIEW, p. 355), he said that mains extensions had been carried out to new localities, and services given to 181 new customers. They had replaced a considerable number of unsuitable and condemned meters, many of which had been in use for 20 years. He could hardly bring himself to believe the extent to which economy in electric light could be carried. In time he hoped they would educate their consumers to use it more freely. The capital account had been increased by the issue of 2,000 preference shares. They were, as usual, very much over-applied for. The lighting receipts were slightly less than in 1910, partly owing to the reductions made in charges to some of the largest consumers, but also owing to the use of high efficiency lamps. There had been several causes which had operated unfavourably for them in 1911, but, on the whole, they had done very well. The year was a record one for sunshine, and people stayed out of doors as long as possible, and practically there was very little light required during the June and September quarters. Luckily, the first and last quarters were more satisfactory and made up the difference. They also had a very satisfactory income from power, cooking and heating, but they suffered greatly from the metal lamps, and would do so until the last limit of efficiency was reached. He hoped that in the future they would increase the revenue more proportionately to the number of lamps. They had a little additional revenue from the Coronation, but the amount received from that in no way compensated them for the loss of one week of term at that period. In regard to the coal strike, this was the third or fourth occasion within recent years that they had had to provide for the contingency of a strike. On one occasion they provided increased accommodation for coal, on another they were threatened with a shortage of Welsh coal, and made certain modifications in their boilers to enable them to use Midland coal. Now they had a national strike they had decided to resort to oil, and they had adopted the Diesel engine, which would to some extent make them independent of coal. They could keep running for two or three months, and by that time, if nothing went wrong, they would have the new engine in position. The fuel for it was now beginning to arrive. It was a three cylinder engine of 650 B.H.P., and it would only occupy the same space as an 80-KW. engine and dynamo, which was now on sale. The chairman went on to allude to the improvements that were taking place in cooking and heating apparatus, to the lack of progress in regard to the local tramway question, and to the enormous progress made in the States with electric vehicles as compared to that observed in this country.

SIR ROBERT BUCKELL seconded, and the report was adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

THE directors' report for 1911 states that the connections to the company's system at the end of the year amounted to 151,627 H.P., which, compared with the previous year's figure of 139,776 H.P., show an increase of 11,851 H.P. The profit for the year is £114,838 (£107,779 for 1910), plus £2,050 brought forward, making £116,888, as compared with £110,702, against which has been charged interest on debentures, loans, &c., amounting to £81,968, leaving an available balance of £84,920 (£78,925 for 1910), which the directors recommend should be appropriated as follows:—Dividend of 5 per cent. for the year on the preference shares (of this an interim dividend of 2½ per cent. was paid in July, amounting to £17,187, £34,375; a dividend of 4½ per cent. for the year on the ordinary shares (of this an interim dividend of 2 per cent. was paid in July, amounting to £13,750), £30,937 (4 per cent. in 1910, £27,500); transfer to depreciation account, £15,000, the same as for 1910; carrying forward £4,608. The reserve account at December 31st, 1910, stood at £6,994, to which has been added £8,054 (being the amount received from the Newcastle Corporation for acquiring the right to supply their tramways in Walker, less Parliamentary and other costs), thereby increasing the reserve account to £15,049. The depreciation account which, at the end of 1910, stood at £115,000 will, when increased by the proposed transfer of £15,000, stand at £130,000. In addition to this, as stated in former reports, the sum of £150,000 was written off in 1906 in reduction of capital expenditure. The expenditure on capital account for the year amounted to £76,950, which has been mainly incurred in completing the new power station at Dunston, and in developing the distribution system, more particularly in the colliery districts served by the company. The development of waste heat generating stations continues. That of the Bankfoot Power Co. at Bankfoot is being doubled in capacity, and the same company are also erecting a waste heat generating station at Bowden Close, near Crook. Agreements for operating these stations, and for taking a supply of the surplus current therefrom, have been entered into by the company. The unconverted balance of first and second mortgage debentures, which at December 31st last amounted to £67,800, has since been exchanged for 4½ per cent. consolidated first mortgage debenture stock, or paid off, and replaced by a corresponding amount of that stock.

The annual meeting is called for March 27th.

Melton Mowbray Electric Light Co., Ltd.

— Mr. W. J. New presided at the annual meeting held on March 13th at the works. He moved the adoption of the report, which showed that the lamps connected had increased from 19,889 to 21,063. The revenue, including the balance of £60 brought forward, amounted to £2,342, and after providing for £1,000 debenture interest, there remained £1,342 for distribution. After paying a dividend of 2½ per cent. per annum, and placing £600 to reserve for plant renewal, £242 is carried forward. The chairman said that the future prospects were favourable. But for the coal strike they might have declared more than 2½ per cent. dividend. The company's stock of fuel would last well over six weeks, but the trouble would probably result in an increase in the price of fuel for some months to come. It would have been an unsatisfactory procedure to increase their dividend this year and then to have to reduce it next year. The report was adopted.

Continental.— BELGIUM.—The balance-sheet of La Société Bruxelloise d'Electricité for the last financial year shows a profit of £5,170, as compared with £4,520 in the preceding 12 months.

AUSTRIA.—The report of the Kabelfabrik und Drahtindustrie Gesellschaft, of Vienna, for the last financial year shows a net profit of £41,396, as compared with only £33,338 in the preceding 12 months. A dividend of 11 per cent is again being declared.

FRANCE.—The balance-sheet of La Société d'Electro-metallurgie de Dives for the last financial year shows a net profit of £73,630, as compared with only £58,188 in the preceding 12 months.

Madras Electric Tramways (1904), Ltd.

Mr. W. S. B. McLaren, M.P., presided on Thursday, last week, at the eighth annual meeting held at Dashwood House, E.C.

The Chairman, in moving the adoption of the report, said the accounts again showed a considerable improvement upon those of the preceding year. Their revenue had been earned entirely on the old lines, and although they thought that their maximum earning power had been reached in 1910, there was an increase in traffic receipts in 1911 of £2,786, or 8·49 per cent. The number of passengers carried was 14,656,611, being an increase of 8·44 per cent. The expenditure in Madras had not been increased, and, therefore, the whole of the improvement in gross receipts was brought in to the credit of the profit and loss account. They had increased the contribution to the depreciation and renewal fund from £5,000 to £7,000. The net result for the year was a profit of £4,846 plus £854 brought forward. The directors recommended a dividend at the rate of 6 per cent. per annum on the preference shares, and a dividend of 2 per cent. on the ordinary shares. Those dividends would absorb £4,595 and leave £1,104 to be carried forward. Turning to the balance-sheet, the usual contribution to the debenture stock sinking fund had been provided out of revenue, and the reserve arising therefrom now amounted to £3,830. They had made temporary arrangements for financing the two extensions which were being carried out, and, as soon as the lines had been opened, they intended to repay the loans out of an issue of debenture stock and shares. In terms of the trust deed for securing the debenture stock, they were entitled to create further stock at the rate of £3,500 per mile of extension. The exact form of the issue had not been settled by the board, but an opportunity would be given to present debenture-holders and shareholders to subscribe. The renewals and improvements during the year, amounting to £5,161, had been debited to the depreciation and renewals account, and there remained at the credit of the fund, including the amount brought forward from last year, the sum of £5,653. In addition to the amount spent in renewals and improvements, there was expended during the year on ordinary maintenance the sum of £3,972. The shareholders would, therefore, recognise that they were steadily improving the condition of the undertaking and, in the course of a couple of years, they hoped to have raised it to the standard of any up-to-date tramway. The additions to the property account include a large double-bogie car which had proved so successful that four similar cars were now being built; and part of the outlay on the extensions to Washermanpet and Royapuram. The former extension was practically completed, and the latter was being pushed on as rapidly as possible. Having been in India in the latter part of last year, he took the opportunity of inspecting the tramway and of making himself conversant with the organisation generally. He considered the latter to be highly efficient and to reflect great credit upon the management. There was still a good deal to be done to the permanent way and rolling stock, but, as he had already said, the next few years would show a great improvement in that respect. He inspected the various parts of the city which had no tramway service, and he was satisfied that there was still plenty of scope for extensions if a concession could be obtained on reasonable terms. Negotiations were now proceeding for a diversion of their lines along Mount Road—the principal business thoroughfare in the city, which would prove a very useful extension. Unfortunately obstacles as to the cost of widening the roads and bridges had prevented a settlement being reached. He had, however, an interview with the Secretary to the Government (local and municipal), and was hopeful that a proposition which he submitted, and which was now under consideration, might prove helpful.

Mr. J. Gray seconded the motion, and the report was adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual general meeting was held on Thursday last week at Moorgate Court, Moorgate Street, E.C., Mr. A. H. Sanderson presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 397), said that the reserve for depreciation amounted to £31,383. The capital expenditure showed a net increase of £7,749, after allowing for machinery written off during the year. That expenditure was less than in the previous year, when it was £9,256. The bulk of that expenditure had been for mains extension. Of the remaining items in capital account, £993 was in respect of meters, which were revenue-earning, and, as they were bought for new consumers, they formed a good and sound indication of the progress of the business. A further sum of £2,300 under the head of investments had been advanced to the Richmond (Surrey) Electric Light and Power Co., Ltd. Revenue from sale of current and rental of meters and indicators amounted to £52,228, as against £50,777 in 1910—an increase of £1,451 as compared with an advance of £570 in 1910. There was an increase of £120 in interest and dividends receivable, due to an enlarged return on their holding in the Richmond company. Trading account had been debited with much greater standing charges this year than before. Apart from its profits, which would certainly increase, that department was instrumental in many ways in developing the business. It was not the object of the directors to make large profits on trading account by cutting prices or competing unfairly with local electrical engineers and contractors, but to exhibit to the public the most artistic and efficient fittings and heating and cooking apparatus, and to afford reliable information, their primary objects being to develop the business and increase the number of consumers. The accounts showed an increase in rates and taxes which included an estimated amount to provide for the Christchurch reassessment lately made. Since the report was issued there had been a readjustment which released £120 under that head, and the actual amount carried forward would be increased by that sum from the figure shown in the report. Turning to net revenue account, interest in debenture stock and temporary loans had increased by £269, through the enlargement of the loan from the bankers. Out of revenue they had written off £1,696 in respect of leasehold and special redemption funds, £637 from suspense account, and £5,000 for depreciation, a total of £7,334. Regarding the progress of the undertaking, the applications received during the year were equivalent to 535 kw., as compared with 402 in 1910, and the number of consumers connected with the company's mains at December 31st was 5,738, an increase of 449. The units sold showed a fair increase, and the division of the output was as follows:—Ordinary lighting, 52·5 per cent.; slot-meter supply, 2·8 per cent.; public lamps at Christchurch, 0·7 per cent.; heat and power, 10·3; traction 33·7 per cent. The revenue from supply of electrical energy to the Bournemouth Corporation tramways during the year had been disappointing, and showed a considerable decrease due to economies effected by the Corporation, and probably to improvements in the running conditions in relation to a large portion of the permanent way. The revenue from lighting showed an increase of £2,418. Income from heat and power was £2,674, or 17 per cent. more than in the previous year. The reduction of the heating rate by 25 per cent., or 1½d. per unit, had been much appreciated, and had doubtless been instrumental in bringing about the increase under this head. The use of the metallic-filament lamps had turned out to be a good friend in disguise, and he believed the time had passed when it could have any but a most beneficial effect on the revenue. As time went on he was sure it would more and more popularise electric lighting by cheapening its cost. The Richmond Co. had had a very satisfactory year, its revenue increasing by 10 per cent., while the applications for lamps showed an increase of 40 per cent. on the previous year. In the case of the Bournemouth and Poole Co., the undertaking had progressed steadily during the year, and its prospects for the coming year were most encouraging. In the year 1912 applications had so far been received amounting to 106 kw., an increase over the corresponding period of 1911 of 21 per cent.; the units sold were 727,055, an increase of 8 per cent.; the gross revenue receivable was £13,346, an increase of 9 per cent.; and the net revenue £7,952, an increase of 9 per cent. With regard to the coal strike, while it was impossible to say how long the strike might last, the general opinion was that it would not extend beyond a month or six weeks, and in that event the company had a sufficient stock of coal to carry it through without dislocation of its business.

Dr. J. Atkinson Hosker seconded the motion, which was unanimously adopted without discussion.

Subsequently a resolution was unanimously agreed to increasing the remuneration of the directors from £1,000 to £1,050.

Brompton and Kensington Electricity Supply Co., Ltd.

The annual meeting was held on Thursday last at Winchester House, E.C., Mr. H. M. Beeton presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 431), said he was pleased to say that the normal growth of their lighting business continued satisfactory. The number of additional consumers connected was above the average, though the number of lamps connected per consumer was naturally smaller than in the earlier years of the business. There was a tendency in Kensington, as elsewhere in London, for many large houses to be sub-divided into flats with the result that more people resided on the same site, and for a longer period of the year, thereby increasing the productivity of their area. The metal lamp continued to supersede the carbon lamp, though at a diminishing rate, and whilst the effect of that was to largely reduce the consumption of current per candle-power, the standard of illumination, encouraged by the more economic lamp, had been raised, and experience justified the assurance that that tendency would continue. On the other hand the demand for artificial light during the past year was restricted by more sunshine in summer, and less fog in winter than usual. The most satisfactory development, because the most promising, was the growth of the accessory demand for cooking and heating, which was largely attributable to the establishment of their showrooms and demonstration kitchen. They had had the benefit of the custom of the Earl's Court Exhibition during the past year, which was lost to them during 1910, and they hoped to continue to enjoy that in the current and subsequent years. The limited participation in the benefit derived from the metal lamp secured by the slight increase in charge for the smaller quantity of current required to furnish the same amount of illumination, had enabled the company to more than maintain its average price, notwithstanding the greater number of low-priced units supplied for cooking and heating. The combined effect of those various factors had been to secure an increased revenue of upwards of £4,000 during the past year. Turning to the expenditure side of the account, although they had sold upwards of 208,000 additional units the increase in expenses amounted to only £121, the cost per unit sold being reduced by ·15d. That was in spite of a slightly higher price per ton paid for coal, and was due to the smaller fuel consumption attributable to the introduction of the turbine, of which they had had a limited benefit during the last half of the year. They proposed extending that type of plant to the point of re-modelling their station, in consequence of which their works cost in future

would more closely approximate to that of stations more favourably situated. The balance of net revenue for the year amounted to £30,700, which approximated closely to the record years of 1906 and 1907. The total capital expenditure during the year amounted to £2,565, after scrapping machinery of the net value of upwards of £6,000, caused by the replacement of three old and inefficient units of plant by the turbine plant to which he had referred. The effect of that policy, which they hoped to still further pursue, would be, so far as they could see, not only to enable them to accommodate in their existing station all the plant required to meet any possible demand which might be made upon them during their tenure, but to ensure an added value to their station and secure a larger capital return in the event of purchase. In that connection it was to be noted that the latest engineering practice went to show that the economies of very large and distant generating units were more than counteracted by the losses on transmission and transformation, and he was disposed to think that the time when a centrally situated station in a limited distribution area, such as they possessed, would be economically superseded, was indefinitely remote. If that anticipation should prove well founded, the result to their shareholders, who, with an unexpired tenure of 19 years, already possessed reserves equal to nearly 60 per cent. of their subscribed capital, was one which would be highly gratifying. How far that outlook might be justified was to form the subject of inquiry by a special committee of the L.C.C., which had been recently appointed to inquire into the situation arising out of the provision of the Electric Supply Acts of 1908 and 1910. Whatever other conclusions that committee might reach, it was safe to predict that it would demonstrate that the resistance of the companies to Brobdingnagian power schemes, much as it cost them, was in the best interests of the public.

Referring to the coal strike, the Chairman said that that affected their business directly by raising the cost of their raw material, and indirectly by impairing the purchasing power of their consumers, and any prospects which could be predicted to-day must be largely subject to the course of events which the future might have in store for them in this regard. The directors, of course, foresaw the lamentable contingency, and they had on hand a stock of coal which should last them for any likely extension of the stoppage. Their supplies on the reopening of the mines would be secured under their current contracts. They enjoyed the services of a contented and devoted staff, with which they had been long associated, and if intimidation arising out of a general strike should ever deprive them of their services, they had made complete arrangements to carry on the business. Subject to exceptional misfortune, the progress of the business since the close of the accounts presented, encouraged him to anticipate sufficiently satisfactory results for the current year.

Mr. W. R. Davies seconded the motion, and the report was adopted.

South London Electric Supply Corporation, Ltd.

The annual meeting of this company was held on Tuesday at the Cannon Street Hotel, E.C., Mr. J. Atherton presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 431), said that during last year the number of lamps added to the circuits was the equivalent of 18,542 35-watt lamps, and the total lamp connections at the end of the year amounted to the equivalent of over a quarter of a million 35-watt lamps, the actual figure being 250,721 and the total units sold amounted to 4,479,487, as compared with 4,101,539 for the previous year, an increase of 377,948 units or 9·2 per cent., producing an increased revenue of £3,356. The costs of production had increased by just over £1,582, so that the gross profit has risen by nearly £1,774. The largest increase in expenditure had been in respect of rates owing to the assessment of the property having been increased at the last re-valuation. They had spent some £350 more than during the previous year on repairs to plant, due to the thorough over-hauling of one of the main engines. All other items of expenditure were about the same as for the previous year, but despite the increased cost per ton of coal, and the fact that they had sold nearly 400,000 units more, the increased cost was only £320, or two-tenths of a penny per additional unit sold. Adding together all the items of expenditure under the revenue account, the amount totalled £19,272, which worked out at 1·03d. per unit sold, or precisely the same cost per unit as in the previous year, and which figure was still one of the lowest attained by any of the companies supplying electricity in the Metropolis. The units sold last year were almost equally divided between the sales for lighting and for power purposes, and although the greater part of the increased output last year was for power purposes, the output for purely lighting purposes was now on the up grade, both as regarded the quantity consumed and the revenue obtained, so that he thought he might safely say that the influence of the metal-filament lamp in depressing their lighting revenue had now been overcome, and that they could confidently look forward to steady progress in sales of lighting units. With regard to the power supply side of the company's business, they last year sold nearly 2¼ million units for this purpose, the horse-power of motors installed having increased by 550 during the year, making the total horse-power connected to the mains 4,000; since the end of last year, many new power consumers had been obtained, and negotiations were in progress with other power users to whom they hoped to supply large quantities of electrical energy in the near future, and in order to provide for this continual increase, more especially for power, they decided after careful consideration of an exhaustive report submitted to them by their engineer and manager to install a further turbine, complete with condensing plant and auxiliaries, but instead of this extension being on the single-phase system to correspond with the whole of the Company's other generating plant, they had decided to change the system of generation from single to two-phase by re-winding some of the existing alternators and providing additional switchgear and cables. The cost of the whole of this work, including extension plant would be approximately £13,000, and they felt sure that when this system of supply was available, it would be readily taken advantage of by many of the larger manufacturers situated in various parts of their area of supply. The contract for the additional plant was let at the end of last year, and unless any unforeseen circumstances arose it would be ready for operation in the first week of September next, and the two-phase supply would then be immediately available for distribution. The capital expenditure during the past year amounted to £7,768, the greater part of which had been expended for extension of mains and for additional transformers and meters to meet the continuously increasing demand for supply. They had last year reconstructed their showroom at the generating station and reorganised their sales department, and the results so far had been satisfactory; the profit on the sale of goods during the year amounting to nearly £700, although the new department was only really at work for nine months of the year. The vital point in their undertaking was, of course, a ready supply of coal, a considerable stock of which they had accumulated, with the result, that although the strike had been in progress nearly three weeks, they were still in the satisfactory position of being able to maintain an undiminished supply from their generating station for several weeks to come, and, in fact, they considered they had taken such precautions that their stock of coal would outlast the strike. The total amount available for distribution was £26,245, and out of this sum they had provided £6,000 for depreciation on plant and machinery. The item for renewals on the other side of the depreciation account amounted to £3,238, and was for the replacement of one of their original wooden cooling towers, and for a complete new high-tension switchboard of the most modern construction to take the place of the original switchboard erected in 1899. This year they would still have to provide a further large amount for writing off the value of the first generating set which was installed in 1898. This plant had been dismantled and sold to make room for the new 2,000-kw. two-phase turbo-alternator; although this plant was only capable of an output of 250 kw., the advance in the construction of electrical generating plant had been so rapid, that in the room of the original set they would be able to easily install the 2,000-kw. turbo-alternator—that was to say, a generator eight times the output of the original plant.

Col. Tatham, a shareholder, seconded the motion, which was adopted after a short discussion.

South Wales Electrical Power Distribution Co.—The directors' report states that the whole of the working expenses in connection with the company's undertaking being now borne by the Treforest Electrical Consumers Co., Ltd., there is, for the time being, no revenue account to be submitted. The directors report that, notwithstanding the disturbance and restriction of trade caused by strikes and labour troubles in South Wales during the past year, the result of the year's working to December 31st shows a material improvement over that of the previous year. The units sold (says the *Financier*) were 2,822,320 in excess of those sold in 1910, and after payment of all working expenses and interest on prior lien debenture stock, and making due provision for depreciation on new plant, there is a small surplus which, under the terms of the agreement with the debenture agent and the Treforest Co., has been added to the suspense account, which is being accumulated for the discharge of certain obligations to the members of the Treforest Co., particulars of which have been given in previous reports. The £30,000 prior lien debenture stock offered for subscription to the share and debenture stockholders of the company on March 23rd last was fully subscribed on the terms set out in the circular letter of that date, and this amount, together with the further capital which is being subscribed by the shareholders of the Treforest Co., is being called up from time to time as required, and utilised in extending the company's system and plant.

London Underground Electric Railways Co.—An adjourned meeting of the holders of 6 per cent. income bonds was held last week, when resolutions were submitted embodying acceptance of the scheme for the acquisition of the ordinary stock of the L.G.O. Co., and approving the draft supplemental trust deed for securing the creation of further income bonds. The chairman, Sir Algernon West, stated that over 90 per cent. of the stockholders of the L.G.O. had agreed to the scheme. The L.G.O. would within 10 days convene a meeting for the purpose of confirming the alteration to their articles of association, and by the end of the present month they hoped to be able to announce that the scheme had become binding.

Winnipeg Electric Railway Co.—The directors' report states, says the *Financier*, that the accounts for the year to December 31st show net earnings of $1,110,573, after providing for all operating expenses, taxes, the City of Winnipeg's proportion of earnings, and other fixed charges. Out of these net earnings the directors declared four quarterly dividends amounting to $690,000, leaving a surplus of $420,573, which has been transferred to the credit of profit and loss account, making a total credit to this account at December 31st of $1,616,773.

The directors have declared a quarterly dividend at the rate of 12 per cent. per annum, payable April 1st.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on Wednesday last week at Winchester House, Old Broad Street, Mr. J. B. Braithwaite presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 395), said that the capital expenditure for the year was £45,814, compared with £50,338 in 1910. The continuous-current turbine mentioned at the last general meeting had been completed and put to work with the most satisfactory results. A third alternating-current turbine was now on order, in pursuance of the board's policy of replacing the old reciprocating plant by generators of the turbine type, and this new machine would be completed in time for next winter's requirements. The second portion of the economiser had been completed, and had had a marked effect on the working costs during the past winter. The duplication of the suction and discharge pipes in the river was proceeding satisfactorily, and would be completed shortly. The remainder of the year's capital expenditure was, of course, due to the normal extension of mains and meters required for the service to new customers and the additional demands of existing customers. The capital value of works demolished during the year was £47,274, as compared with £44,270. As he had stated, the company was deliberately pursuing the policy of replacing the old generating plant by turbines, and as each old generating set was removed its entire original cost was struck out of the capital account. Modern plant was cheaper to buy, and consequently, although the generating capacity of the station had been increased, and the value of the station as revenue-earning works greatly improved, the asset from the point of view of capital expenditure only had diminished. For these reasons the net capital expenditure at the end of 1911 showed a shrinkage of £1,460. The total reserves in hand had been increased by £6,471, notwithstanding the larger amount written off. The gross revenue had increased by £9,455, of which they had been able to retain £5,111 as net profit, the additional expenditure having amounted to £4,344. There had actually been a smaller expenditure upon generation and distribution, which fact reflected the greatest credit upon their technical staff. They had produced 1,500,000 more units than last year, and the cost of generating had gone down by £1,317. They had decided to raise the dividend on the ordinary shares from 7 to 8 per cent., and he was glad to say there was every prospect of that increase being maintained. Besides increasing the dividend, they had put £50,000 to reserve, and they were carrying forward considerably over £20,000. The most satisfactory feature of the year was the increase in the business, which was considerably more than in the previous year. There was, he was satisfied, still room for a considerable expansion, as he felt sure that electricity would continue to make its way in public favour for power, lighting and heating purposes. The coal strike was inducing many people to look to the possibilities of electricity for those purposes, and those persons who were using electricity at the present time were, no doubt, congratulating themselves that they were not affected by the coal strike. They had got sufficient coal to last them for a very long time, stored at their depôt at Bankside.

Mr. F. W. Reynolds seconded the motion, which was adopted.

Metropolitan Electric Supply Co., Ltd.

The annual meeting was held on Tuesday, at Winchester House, E.C., Mr. W. Harrison Cripps presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 433), said that at the end of 1910 the capital expenditure had amounted to £1,936,000 odd; it now amounted to £1,989,000, or an increase of £53,000 during the year. The revenue in 1910 was £172,000; last year it was £182,000, an increase of £9,800. The costs in 1910 were £78,200; last year they were £88,000, or an increase of £9,700. If they deducted the working costs from the income there was £94,600 left. The directors proposed this year to put by £17,000 to depreciation, which left a net revenue of £77,610. To that must be added interest on their various investments, which brought up the amount to £88,412. From that had to be deducted the debenture interest, the interest on the preference shares, and the interest on loans. After those deductions a balance was left of £42,356, which was available for ordinary dividend. Of that amount £20,000 was paid last August, and the directors proposed to pay a similar amount now, that was, at the rate of 4 per cent., carrying forward £2,356. As regarded the capital expenditure last year, it was somewhat more than the average of the past few years. It had been partly spent upon the development of their old district, but chiefly in the development of their new areas of Hanwell, Southall, Brentford, and to some small extent in Acton. Capital spent upon new districts could not expect to fructify immediately, it must require time, but he considered that the results from that capital were already good, and that they had got prospects of a good return upon it in the future. The capital required last year was obtained by the sale of £43,000 worth of their 3½ per cent. debentures, and they still had £146,000 of that issue left to draw upon from time to time if necessary. The gross revenue increased by £10,000 odd in the year. That in itself was, of course, satisfactory; but it was practically wiped out by the increase in their costs. That required some explanation. First of all, the coal cost was considerably more than in 1910. Then, again, when they opened a new district—Southall and Hanwell were opened last year—there was a considerable amount of standing charges which had to be made and provided for before any units were sold and provided for. Naturally for the first few months they got no return at all. They were working that new district by a system which was entirely new to this country. It seemed to be an admirable system, and was introduced by Mr. Highfield, their engineer. It was started about nine months ago, and he could say, without any reservation, that it had worked without any hitch or hindrance day or night since the day it was started. That result, of course, was not obtained without a great deal of thought and a good deal of experimental work before it was got into condition. It was the high-tension direct-current system, and they had laid a cable, the copper in which was very thin, and which was capable of carrying the enormous voltage of 100,000 volts. When they first started a district there was, of course, comparatively little demand, but instead of using 100,000 volts, they began by working at a pressure of 2,000 or 3,000 volts; then as the load increased they could use 4,000, and so on, but as months ran on into years they could gradually work up to the full 100,000 volts; and at 100,000 volts the cable was capable of supplying 13,000-H.P., which was about 25 times the amount that was supplied to-day. They had got the cable laid and it would do 20 or 25 times the amount of work that was required of it at present. Turning to the rates, they had increased during the year by between £2,000 and £3,000, although the Company had had a diminished net income. The sting about the rates was not so much in the actual amount they had to pay, but the great costs which were involved in getting the rates diminished. Their mains ran through seven or eight different rating districts with the result that they had to fight each assessment separately, and much of the money which they eventually saved on the rates was spent in getting them down. A more unjust system could not be conceived. What ought to be done was to establish a single tribunal which should hear the case and adjust the whole matter. It was, however, extremely difficult to get anyone to take up this rating question. It would surprise them to learn that for every £8 they received in dividend the rating authorities received £3—something more than one-third. The shareholders ran all the risks, but they were absolutely unrepresented in the spending of the money. They knew a great deal of it was wasted, and the only person who represented their interests was the hall porter. A few words about their coal supply would be interesting. Early last year there was some threatened trouble in the coal districts, and at that time they laid in a considerable quantity of coal. They usually kept a fortnight's or three weeks' supply, but they then laid in a sufficient supply for six weeks. But as the strike became more within measurable distance, they still further increased the quantity, and when the day of the strike arrived on March 1st, they had, on a most careful estimate, sufficient to supply their customers without restrictions of any sort for 10 weeks. They thought that was a sufficient margin. If the strike should last beyond that time, it was quite obvious that it would no longer be a question of companies or individuals, but that it would be a vast national question, over which, as a company, they would have no control. They had increased the reserve fund this year by £2,000, and in one sense they had increased it at the other end by not taking out of it any of the undivided part of the Marylebone award, which they had put by as a nest egg for the equalisation of dividends. They thought it better to do this and pay only 4 per cent., and so put their reserve into a better condition. They were also carrying forward something like £1,500 more. The reserve fund now amounted to £277,000, which was a very hand some reserve. In conclusion, the Chairman paid a tribute to the staff, especially Mr. Highfield, the engineer, and the secretary, for their services, and to the workmen who, he said, were thoroughly loyal and contented.

Sir J. Pender, Bt., seconded the motion.

The Chairman, replying to questions, said he did not like to prophesy, but he thought their future was extremely hopeful. In the year 1910 the increase in their connections was equivalent to 43,000 lamps. If the business was not progressive, they would have expected that to have remained stationary or to have diminished, but the actual improvement last year was 66,000 lamps, which included a large number in the new districts which had not yet become remunerative. With regard to the public lighting at Holborn, they now supplied half the district, and the gas company supplied the other half, which was a better arrangement than if each had tried to cut out the other by tendering at cost price. As to their concession, it ran in perpetuity. Nobody could touch a penny that they had spent at Willesden, and in their new areas they had got a 42 years' agreement. It was only after careful thought and deliberation that the board had come to the conclusion that in this particular year it would be better to advise the shareholders to accept a 4 per cent. dividend instead of a 5 per cent. and put part of the difference to the reserve fund.

The report was adopted.

Huelva Gas and Electricity Co.—The directors report that the net profit for the year 1911 amounts to £2,612, plus £3,125 brought forward. The directors recommend a dividend of 4 per cent., free of tax, and that there be written off for depreciation of gas and electric plant £1,300, leaving £825 to be carried forward, subject to directors' and auditor's fees. According to the *Financier*:—"In view of the miners' strike the directors considered postponing the declaration of any dividend out of the profits of last year, but decided that the year 1911 should be kept by itself. Coal has had to be bought, however, for present shipment to Huelva, at prices which will seriously affect the results of the current year, and the directors think it well to give this intimation to the shareholders."

Guildford Electricity Supply Co., Ltd.

The directors' report for the year ending December 31st, 1911, states that the company again made very satisfactory progress, the gross receipts being £8,679, as compared with £7,885 for the year 1910, thus showing an increased revenue of £794. The accounts show that there is a balance on the revenue account of £3,303 (after crediting depreciation fund account with £1,000) as compared with a balance of £3,445 (after crediting depreciation fund account with a like amount) on the revenue account for 1910. After making due provision for debenture interest, dividend on preference shares, &c., and the placing of £400 to the credit of reserve fund account, the net revenue account shows a balance of £988 for distribution. Out of this sum the directors recommend the payment of a dividend at the rate of 5 per cent., less tax, for the past year on the ordinary share capital of the company, which will absorb £701, thereby leaving a balance of £286 to be carried forward. The following table shows the progress of the company's business during the past three years :—

Year.	No. of connections.	Total revenue.	Total costs.	Gross profit.
1909 ..	744	£7,490	£3,198	£4,292
1910 ..	807	£7,885	£3,441	£4,444
1911 ..	874	£8,679	£4,376	£4,303

	1911.	1910.
Units sold—Lighting	295,930	275,160
Power and heating	256,515	201,276
Total sold ..	552,445	476,436
H.P. of motors connected ..	553	469
Total number of connections	874	807

Mr. C. W. Dixon was elected a director in December last to fill the vacancy caused by the retirement of Mr. E. E. Pullman.

Salisbury Electric Light and Supply Co., Ltd.

The directors' report for the year ended December 31st, 1911, states that the generating plant was sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £325 brought forward from last account, amounted to £6,340, and after paying £1,390 interest on debentures and an interim dividend at the rate of 4 per cent. for the half year, amounting to £700, there remained a balance of £4,249. The directors recommended that a further dividend at the rate of 8 per cent. for the half year be paid, making with the interim dividend, 6 per cent. for the year, and that £2,400 be carried to reserve, leaving £449 to be carried forward. The annual meeting was held on March 12th, when the report was adopted and the dividend declared.

	1909.	1910.	1911.
Units generated	630,618	651,549	684,297
Quantity sold—Public lamps ..	10,200	10,200	6,120
Private consumers by meter ..	513,843	529,958	559,832
Total	524,043	540,158	565,952
Used on works	53,848	57,480	61,704
Total used	577,891	597,638	627,656
Expended in distribution	52,737	53,910	56,551
Public lamps	33	33	33
Total maximum supply demanded..	332 kw.	321 kw.	318 kw.

Diesel Engine Co., Ltd.—The following circular has been issued by the secretary to the shareholders: "With a view to the enlargement of the scope of this company's business and the enhancement of the value thereof, the board have, for some time past, had on hand important negotiations, which are expected to eventuate in a few days in a completed scheme. With this in view it has been necessary to have the company's assets examined, and expert advice has been taken of their value. On the basis of the figures furnished by the experts it would appear that the value of the shares is—including current dividends—preference shares par, and ordinary shares 3s. 4d. each. My board has thought it right to inform you of this, and to intimate the negotiations on hand, and I am directed to state that the shareholders will be called together at the earliest possible date to consider the proposed new arrangement, which, in the opinion of my board, there can be no doubt will be highly satisfactory and beneficial to the shareholders."

Newmarket Electric Light Co., Ltd.—The directors' report for the year ended December 31st, 1911, states that the equivalent of 1,051 33-watt lamps have been connected to the mains, making the total at the end of 1911 27,039 lamps. Applications for a further 224 lamps have been received this year. The whole of the works have been maintained in perfect working order. The profit on the year's working, added to £58 brought forward from the last account, amounts to £2,480, which, after providing for debenture and other interest, £757, leaves a balance of £1,723. The directors recommend the payment of a dividend of £4 per cent.; that £650 be carried to reserve for renewal of plant, and that the balance be carried forward. The directors regret the death of their chairman, Mr. G. H. Verrall, last year. Mr. H. J. Garrod was elected chairman in his place for the remainder of the year, and Mr. George Blackwell, of Newmarket, was elected a director.

Isle of Wight Electric Light and Power Co., Ltd.—The directors after paying interest on debentures and loans, also the preference dividend (5 per cent.), recommend that the remaining £7,614 be disposed of as follows:—1 per cent. dividend on the ordinary shares, £3,500 to renewal fund account, £1,000 to reserve, carrying forward £2,115.

British Insulated and Helsby Cables, Ltd.

The directors' report for the year ended December 31st, 1911, states that the profit for the year amounts to £188,259, plus the balance brought forward, £42,320, making £230,579. From this have to be deducted directors' and debenture trustees' fees, and remuneration to Works' Committee, £5,316; interest on first debenture stock, £22,500; interest on second debenture stock, £8,112; depreciation on buildings, plant, machinery, &c., £20,000; transfer to reserve account, £10,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; balance of commission on issue of second debenture stock, £7,500; dividend on preference shares to December 31st, 1911, £30,000; interim dividend on ordinary shares to June 30th, 1911, £20,000, leaving available for dividend a balance of £93,651. The directors recommend the payment of a further dividend of 6s. per share on the ordinary shares, making, with the interim dividend already paid, a total of 10 per cent. for the year ended 31st December, 1911, £30,000, carrying forward £63,651. There has been an increased turnover during the year, owing in large measure to better trade conditions, and this has resulted in £44,954 more profit being earned than in the previous year. A sum of £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £10,000 to reserve account, £20,000 applied to depreciation on buildings, plant and machinery, and £7,500 (the balance outstanding) written off commission on issue of second mortgage debenture stock, the amount carried forward being £63,651. The company's Liverpool works and business were sold at the end of last year to a new company named the Automatic Telephone Manufacturing Co., Ltd. From the prospectus (a copy of which was posted to each shareholder when issued in November last), it would be seen that this company had guaranteed the payment of the dividend on the 200,000 preference shares of that company, which guarantee will continue until the general reserve fund of the Automatic Telephone Co. amounts to £100,000.

The meeting is called for March 25th.

County of Durham Electrical Power Distribution Co., Ltd.

The directors' report for 1911 shows that the total connections to the company's system at the end of the year (including the connections of its associated Parliamentary company, the County of Durham Electric Power Supply Co.) amounted to 43,525 H.P., which, compared with the previous year's figure of 39,070 H.P., show an increase 4,455 H.P. The profit for the year amounts to £32,031 (an improvement over the previous year of £3,325), plus £158 brought forward, making £32,189, against which has been charged interest on loans and debenture stock, £13,527, leaving an available balance of £18,662. A dividend of 5 per cent. for the year on the preference shares absorbs £12,500; there is transferred to depreciation account £6,000, and carried forward £162. The expenditure on capital works during the year has been £12,597, of which £5,004 represents the outlay on the company's account, and £7,594, the outlay on behalf of this company's associated company, the County of Durham Electric Power Supply Co., for which this company receives shares therein.

The meeting is called for March 27th.

Galloways, Ltd.—According to a financial contemporary the directors report that, after transferring £5,182 to depreciation, the profit for 1911 was £1,606. Debenture interest and special non-recurrent loss entailed a net deficiency of £6,070, increasing the debit at profit and loss to £26,138.

Liverpool District Lighting Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. per annum for the half-year ended December, 1911.

Prospectus.—*County of London Electric Supply Co., Ltd.*—The list opened yesterday, and is to close to-day, in an issue of 19,000 ordinary shares of £10 each. We understand that the entire amount will be taken up by existing holders.

STOCKS AND SHARES.

Tuesday Evening.

The feature this week in the markets with which we deal is the series of rises amongst London Electric Lighting Companies' shares. It is an ill wind that profits nobody, and the coal strike—the cause of so much misery, unhappiness and inconvenience to the community—has, at all events, been one ostensible reason why these electric lighting shares have risen so substantially. Another noticeable feature is the remarkable rise in Central London Railway stocks, the Deferred especially being favoured, while Undergrounds, as a whole, continue in high favour.

The lead to the Lighting market was supplied by City of London Ordinary, the price mounting to 19 on Friday last, against 15 a few days previously, the latter price in itself representing a material improvement since the beginning of the year. To justify this jump, the story was re-affirmed to the effect that the Corporation of London intended to buy out the City of London Electric Lighting Company, a rumour which we referred to, of course, last week,

Denial has been as strenuous as re-affirmation, and colour is lent to the suggestion by the fact that if the Corporation takes no steps in 1914, the London County Council can come in as the purchasing authority in 1931. As brotherly love between these two bodies is at a heavy discount, it is maintained by some people that the Corporation is certain to exercise its right—and perhaps even earlier than in 1914. The price of 18 is, it must be admitted, a fairly tall one in any circumstances; though if the Corporation were intent upon buying at all costs, conceivably the current quotation would be found warranted by the course of events. Even this (Tuesday) afternoon a single line of 250 shares changed hands at 18.

Another important consideration, however, in connection with these London companies is that some manufacturers are said to be changing—or thinking of changing—their plant from steam to electrically-driven machinery. There can be little doubt that the coal strike will make steam-users look round for some other motive power upon which they can fall back if coal fails them, and so the report just mentioned gained a ready hearing, if not entire credence. At any rate, it proved quite broad enough base upon which to ground further optimism in respect of lighting shares; and although in good quarters this security for the rise is considered very sketchy, the Stock Exchange market is more buoyant than it has been for a long time past.

County of London shares proved a good second to Cities, and the price of the Ordinary is up 30s. on the week, allowing for deduction of the dividends. If, says rumour, the City Company is going to be taken over by the Corporation, efforts may possibly be made to acquire portions, at all events, of the County Company and the Charing Cross Company, and on the strength of these suppositions quotations have been raised in each case. The market, however, is a difficult one, in illustration of which we may cite the fact that a broker had an order a day or two ago to buy 100 Charing Cross, and he was not able to get more than quarter of his shares, dealers simply refusing to offer them at all. Westminsters rose £1 to 9¼, but this price tempted sellers, and it fell back to 9. St. James's put on ¼. Chelseas recovered the dividend. Metropolitans and London Preference both gained ⅛, and the market all round has been strong. It would be a little remarkable, in these circumstances, if some of the companies were able to resist the temptation to offer fresh capital to their shareholders, for they have had little chance of doing so during the past few years, and no doubt several of them can do with extra money for extensions and so forth. Indeed, it is quite probable that the County of London Company will be in the field with a fairly large issue within the next day or two, and other companies are likely to follow its example. Apart from the reasons given above for the animation in these London shares, it is, of course, a fact (which readers of these notes will readily appreciate) that prices fell to an unduly low level, from which a reaction was certainly to be expected; but whether the recognition of this has not been carried far enough during the rise of the last week or two can best be judged by those in closer touch with the industry itself than a mere writer of financial notes can be.

Central London Deferred has risen no less than 17 points. The Ordinary gained 9 and the Preferred 1, buying having been stimulated by reports that the company is about to be included in the Underground fusion of interests, while another report declared the London and South-Western Railway to be making overtures to the Central London in respect of the Thames Valley extensions contemplated by both companies. Considering that it takes a modicum of buying or selling to cause big movements in the prices of the stocks, the rises are, perhaps, less extraordinary than they appear on the surface. But official statements are eagerly awaited, and, in the meantime, some people are taking advantage of the rise to clear out of stock which they bought much more cheaply. City and South London Ordinary regained its three-point fall of last week, and has spurted to 38 again; while Metropolitans at 58¾, and Districts at 37 both show good rises. Underground Electric Railway shares put on ¼ and the income bonds gained 5. In view of the excellent services which the Underground have managed to maintain up to the present, no doubt public imagination has been attracted by reason of the contrast afforded by the steam lines. British Electric Traction Preferred stocks are a little easier.

Telegraph stocks and shares are still a little bit fearful of the Marconi competition, and although in one or two cases there are slight recoveries, the market on the whole is dull. Marconis themselves are without nominal change on the week at the time of writing, but Canadian Marconis, in which the special settlement is taking place, have jumped up from 27s. 6d. to 33s. 3d. Spanish Marconis have been somewhat neglected at 1½. West India and Panama shares have steadied to 4½, and Anglo "A" fell ¼ again. Amongst Telephone issues, American Telephone capital stock rose 2, National Telephone Deferred lost 1½, and United River Plate Telephones are ¼ higher. Business in this department, however, is very quiet.

The Manufacturing group is almost equally quiet. Babcocks are nominally easier, but Castner-Kellners hardened to 3⅛, and Callenders Cable braced up 10s. to 9¼. On the other hand, Willans and Robinson Preference lost their recent rise, and fell back to 20s.

Amongst the Latin-Canadian issues, the news from Mexico is still very mixed, but there seems to be an impression that the worst is over and that the revolutionaries will soon settle down. Consequently, Mexico Trams regained 2, and recoveries have occurred in Mexican Light and Power issues and Mexico Electric Lighting bonds. The feature perhaps in this section is a rise of 4 points in Shawinigan Water on dividend prospects. Calcutta Trams are a good market with a ⅛ rise, and Sao Paulo, *ex* their dividend, are up to 200. The market is very steady, and there is a good demand for most of the bonds.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Aberdeen	Mar. 3	2,627	+ 54	41	60,909	+ 3,459	14·4	..
Ayr	„ 16	389	+ 19	44	13,103	+ 160	8	..
Bath	„ 16	1,398	+ 66	11	7,407	+ 307	14·75	..
Birkenhead ..	„ 17	2,178	+ 174	50	57,187	+ 2,228	13·68	..
Birmingham Corp.	„ 9	20,891	+6,516	49	414,028	+101,818	56·4	..
Blackburn	„ 13	1,942	+. 54	50½	57,367	+ 4,812	14·62	..
Blackpool Corp. ..	„ 14	820	— 65	..	63,213	+ 7,771	11·87	..
Blackpool-Fleetw'd	„ 16	610	+ 128	10	2,936	+ 247	8	..
Bournemouth ..	„ 13	3,076	+ 317	50	87,705	+ 1,429	21·95	..
Bradford	„ 9	9,968	— 10	49	266,389	+15,491	56	1·2
Brighton	„ 17	1,540	+ 49	38	50,537	+ 2,742	9·5	..
Bristol	„ 15	12,046	+1,242	11	66,142	+ 6,063	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 8	563	+ 130	10	2,634	+ 592	3·65	..
Barnsley	„ 8	237	— 23	„	1,760	+ 117	..	..
Barrow	„ 8	661	+ 164	„	2,974	+ 750	5·37	..
Devonport ..	„ 8	1,008	+ 133	„	4,756	+ 646	8·85	..
Gateshead ..	„ 8	2,039	+ 21	„	9,771	+ 185	11·25	..
Gravesend ..	„ 8	389	+ 24	„	1,890	+ 191	6·5	..
Greenock ..	„ 8	1,502	+ 227	„	6,707	+ 932	7·25	..
Hartlepool ..	„ 8	478	+ 48	„	2,250	+ 220	6·72	..
Kidderminster ..	„ 8	190	+ 17	„	874	+ 75	..	..
‡Leamington ..	„ 8	272	+ 3	„	1,314	+ 77	..	..
Merthyr	„ 8	335	+ 1	„	1,855	+ 79	2·9	..
Metropolitan ..	„ 8	16,984	+ 912	„	79,389	+ 6,264	22	..
Middleton ..	„ 8	595	+ 11	„	2,654	— 48	8·5	..
Mid. Joint Com'tee	„ 8	6,228	+ 281	„	28,412	+ 823	..	..
Oldham—Ashton	„ 8	1,122	+ 50	„	5,248	+ 266	9·13	..
Peterborough ..	„ 8	238	+ 30	„	1,104	+ 155	5·31	..
Potteries	„ 8	3,764	— 142	„	18,777	+ 648	29	..
Rothesay	„ 8	101	+ 14	„	485	+ 64	2·75	..
Southport	„ 8	497	+ 35	„	2,217	+ 22	8·17	..
S. Metropolitan ..	„ 8	1,461	+ 37	„	6,636	+ 137	..	..
Swansea	„ 8	2,253	+ 122	„	10,636	+ 552	12·5	..
Tynemouth ..	„ 8	306	— 6	„	1,328	— 92	3·75	..
Weston-s-Mare ..	„ 8	51	+ 16	„	252	+ 88	3	..
‡Worcester ..	„ 8	496	+ 10	„	2,286	+ 62	5·75	..
Wrexham	„ 8	192	+ 11	„	897	+ 59	..	..
Yorks. Wool. Dist.	„ 8	2,099	+ 131	„	9,931	+ 350	17	..
Miscellaneous ..	„ 8	428	+ 38	„	1,935	+ 93	..	..
Burnley	„ 16	2,785	+ 868	..	..	..	11·73	..
Burton-on-Trent ..	„ 17	520	+ 45	50	14,306	+ 764	6·6	..
Bury	„ 17	2,502	+ 281	50½	68,615	+ 4,863	23·5	..
Cardiff	„ 16	4,960	— 12	50	121,604	+ 8,543	17·35	..
Chatham and Dist.	„ 7	1,594	+ 32	10	7,309	— 5	14·98	..
Cork	„ 14	1,080	+ 46	11	4,529	+ 10	9·89	..
†Croydon	„ 1	1,682	+ 107	48	85,286	+ 5,539	11·6	·75
Darlington	„ 16	420	+ 25	51	11,225	+ 1,027	4·57	..
Darwen	„ 15	802	+ 54	50	13,247	+ 873	4·36	..
Dover.. ..	„ 9	391	+ 43	49	12,190	+ 1,591	4·75	..
Dublin	„ 15	10,705	+ 612	..	56,283	+ 3,449	54·25	..
East Ham	„ 16	2,114	+ 109	50	55,235	+ 3,677	7·87	..
Exeter	„ 15	547	+ 24	50	16,682	+ 1,051	5·5	..
Glasgow	„ 16	57,676	+1,779	..	780,122	+42,074	98	·25
Hastings	„ 14	1,512	+ 35	..	..	+ 271	19·3	..
Huddersfield ..	„ 16	3,710	+ 217	44	95,622	+ 8,028	29·5	1
Hull	„ 16	5,871	+ 389	50	147,747	+ 8,435	14·5	..
Ilkeston	„ 14	204	— 33	50	6,486	+ 114	3·8	..
Ipswich	„ 16	695	+ 30	50	21,696	+ 1,127	10·5	..
Kilmarnock	„ 9	289	+ 8	48	6,984	+ 468	4·25	..
Lancashire United	„ 13	2,347	— 101	11	12,674	+ 185	39	..
Leeds	„ 16	14,117	+ 838	50	376,779	+24,888	57·5	..
Leicester	„ 16	5,060	+ 511	..	..	..	20	..
†Leith	„ 9	604	+ 38	49½	27,559	+ 2,128	8·72	..
Liverpool	„ 9	23,270	+ 790	9½	118,464	+ 6,382	116	..
‡L.C.C.	„ 6	86,401	+2,443	..	2,188,585	+104,087	130·5	3
London United ..	„ 16	11,058	+ 184	11	58,159	+ 980	..	..
Lowestoft	„ 16	259	— 2	24	3,823	+ 35	3·5	..
Manchester	„ 16	33,303	+3,230	50	813,845	+44,698	105	..
Newcastle	„ 16	8,367	+ 376	..	214,799	+15,669	31·3	..
Newport	„ 9	1,336	+ 15	49	34,540	+ 1,143	7·25	..
Oldham	„ 17	3,925	+ 223	51	98,419	+ 4,458	23	..
Pontypridd ..	„ 16	678	— 107	50	20,611	— 90	5·5	..
Portsmouth ..	„ 16	3,460	+ 132	50	107,229	+ 7,384	15·25	..
Preston	„ 13	1,448	— 12	50	38,814	+ 2,622	10	..
Rotherham	„ 14	1,210	— 79	45½	34,342	+ 2,467	12	..
Salford	„ 18	9,561	+ 706	50½	244,537	+10,207	41	..
Sheffield	„ 19	12,221	+ 141	51	330,847	+20,181	40	..
Southampton ..	„ 13	2,182	+ 212	50	61,104	+ 7,093	11	..
Southend-on-Sea ..	„ 18	1,030	+ 148	50	34,067	+ 5,208	7	..
South Shields ..	„ 16	1,101	+ 55	50	31,025	+ 3,175	10·25	..
Swindon	..	..	..	..	..	..	..	..
Tyneside	„ 13	883	+ 82	11	4,878	+ 220	11	..
Wallasey	„ 16	2,249	+ 377	50½	54,747	+ 6,719	8·72	..
Walthamstow ..	„ 16	1,341	+ 108	50	36,852	+ 2,286	9	..
†West Ham	„ 7	2,598	+ 152	49	132,901	+11,509	15·25	..
Wolverhampton ..	„ 13	1,883	+ 111	50	49,078	+ 2,277	13·75	..
Cen. London Rly.	„ 16	9,723	—1,041	11	55,628	— 3,750	6·22	..
City & S. Lon. Rly.	„ 17	6,694	— 249	11	37,240	— 1,012	7·26	..
Dublin-Lucan Rly.	„ 15	233	+ 1	11	1,1·8	+ 1	7	..
G.N. and City Rly.	„ 16	3,386	+ 163	11	18,778	+ 1,205	3·5	..
L'pool Overh'd Rly.	„ 17	2,928	+ 191	11	16,260	+ 1,155	6·6	..
Llandudno-Col. Bay	„ 15	293	+ 20	15½	2,057	+ 189	6·2	..
Lond. Elec. Ry. Co.	„ 16	28,795	+ 255	11	163,395	+ 7,115	21·25	..
Mersey Railway ..	„ 16	3,991	— 122	11	22,710	+ 364	4·5	..
Metropolitan Rly.	„ 17	31,499	—1,788	11	186,092	— 166	25·75	..
Met. District Rly.	„ 18	25,099	+ 587	11	139,551	+ 7,189	25	..
†Anglo-Argentine ..	„ 11	111,453	+9,899	10	513,878	+21,374	..	..
‡Auckland	Feb. 9	17,810	+1,284	..	137,109	+11,048	23·3	..
Bombay (B.E.T.) ..	Mar. 16	6,373	+ 452	7	20,568	+ 1,775	..	..
‡Brisbane	Feb.	6,700	—1,975	8	23,734	—13,101	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Mar. 16	8,008	+ 800	..	..	+ 5,814	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A. ..	Feb.	2,684	..	8	5,568	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 15	1,584	— 141	10	7,728	+ 190	..	..
‡Montevideo ..	Feb.	85,021	+5 229	4	125,883	+13,387	..	..
Perth (W.A.) ..	Mar. 15	3,751	+ 506	11	20,718	+ 3,091	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations March 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord. ..	10	5⅛	5⅛	8⅛ — 9⅛	..	5 18 11
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10⅜ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord...	5	10	9†	8⅜ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8⅛	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	4⅛ — 4⅜ xd	+ ⅛	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅞ — 4⅜	+ ⅛	5 2 10
Do. Do. 4 % Deb... ..	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅜ — 5 xd	+ ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	17 — 19 xd	+3½	4 4 3
Do. 6 % Cum. Pref.	10	6	6	13⅛ — 15½ xd	+2½	8 19 2
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord... ..	10	5	6	10½ — 11½ xd	+1½	5 4 4
Do. 6 % Pref.	10	6	6	11½ — 11⅝ xd	+ ⅛	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb. ..	Stock	4½	4½	101 —104	..	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 3⅛	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	—1	5 1 2
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6½ — 7½	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	6⅝ — 7⅛ xd	..	6 6 4
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1½ — 2	+⅛	3 15 0
Do. 6 % Pref.	5	6	6	4½ — 5½	+ ⅛	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4†	3½ — 4	+ ⅛	6 5 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne	5	4	4†	3⅞ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum. ..	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅜ xd	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8⅝ — 8⅞	+ ⅛	5 16 0
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1⅝	..	..
South London, Ord.	4	5	5	2⅞ — 3⅛	..	6 3 1
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref...	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	5	5	..	⅞ — 1	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord, ...	5	10	10	8½ — 9½	+ ⅜	5 5 8
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	7†	6½ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5¼	+ 1/16	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 3
Canadian Gen. El. Com. ..	$100	7	7†	115 —119	+1	5 17 8
Do. 7 % Pref.	$100	7	7	116 —120	..	5 16 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	88 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	+½	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — 1	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	108 —110	..	4 11 0
Madras, Ord.	5	..	.	2⅜ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84½ — 86½	+ ½	5 15 7
Mexican Lt. & Power, Common	$100	4	4†	84 — 86	+2	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	+1	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	+ ½	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	192 —197	..	3 11 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	..	248 —258	..	3 17 6
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	101½—103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	4	5†	133 —135	+4	3 14 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	+1	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	103½—105½	..	4 5 4
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref. ..	1	Nil	11¾d.	⅛ — ⅜	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½ —106½	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅜	..	..
Do. 5 % Deb. Red.	Stock	5	5	97⅞ — 99⅜	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	150 —152	+2	5 5 3
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph ..	Stock	3⅜	3	66 — 68	..	4 8 6
Do. 6 % Pref.	Do.	6	6	11⅛—111½	+½	5 7 10
Do. Def.	Do.	30/-	30/-	25⅛— 25½	— ⅛	5 16 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100 —102	..	4 18 0
Chili Telephone	5	7	..	7¼ — 7½	..	4 13 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	9⅜ — 10⅜	— ⅛	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable ..	10	4½	..	7⅜ — 7⅝	+ ⅛	5 14 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 —132	—1	5 6 1
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	81½ — 83½	—1	4 3 7
Do. 4 % Mort. Deb.	Do.	4	4	100½—102½	..	3 18 1
Eastern Extension	10	7	5†	12½ — 13	— ½	5 7 1
Do. 4 % Deb.	Stock	4	4	9⅝—101½	..	3 18 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust ..	10	5⅞	6†	10½ — 11	— ⅛	5 9 1
Do. 6 % Pref.	10	6	6	12½ — 13½	..	4 10 7
Great Northern Telegraph ..	10	18	5†	34 — 38	..	5 9 1
Indo-European Telegraph ..	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common ..	$100	5	5†	82 — 85 xd	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	72 — 75 xd	- 2	5 6 8
Marconi's Wireless Telegraph	1	5	..	4 1/16 — 4 1/8	..	..
Do. 7 % Cum. Partic. Pref.	1	16	..	4⅛ — 4¼	..	..
Monte Video Telephone, Ord. ..	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	5 10 6
National Telephone, Pref. ..	Stock	6	6†	99⅝—102½	..	5 17 1
Do. Def.	Do.	6	6†	125⅛—127½	—1½	4 14 1
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	.. — ..	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 5½	..	4 15 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102⅜—103⅝	— ½	4 6 9
Oriental Telep. and Elec. ..	1	8	..	1⅜ — 1⅝	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 10
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98½—100½	..	3 19 7
Reuter's	8	5	5†	10¼ — 11¼	..	3 10 11
Submarine Cables Trust ..	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅛ — 7⅞	+ ⅛	5 8 3
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	1¼	1¼†	4⅛ — 4⅜	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜ — 11½	..	5 6 8
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 10⅜	..	5 6 8
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd. ..	10	7	6†	13⅜ — 13⅝	— ⅜	5 2 7
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds.. ..	$1000	4½	4½	102 —105	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations March 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — 7/16	..	Nil
Do. 5 % Pref.	1	5	5	⅜ — ½	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	13 — 15	— ½	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	91½ — 93½	..	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	— ½	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	50 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	82 — 84	+9	3 11 5
Do. Pref.	100	4	4	85 — 87	+1	4 12 0
Do. Def.	100	2	2	77 — 79	+17	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1½	1⅝	37 — 39	+3	4 3 4
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	102 —104	..	4 16 2
Do. Do. 1901	100	5	5	101 —103	..	4 17 1
Do. Do. 1903	100	5	5	101 —103	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅞ — 11⅜	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅜ — 1⅝	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅜ — ½	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2¼	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅝ — 4⅛	..	..
Do. 4 % Deb.	100	4	4	75⅝ — 78⅝	..	5 1 11

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations March 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Metropolitan Railway Consol.	100	1⅜	1⅞	58½ — 59	+2	3 3 6
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	..	3 18 7
Do. 3½ % Deb.	100	3½	3½	84 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	36⅜ — 37½	+1⅛	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 6
Do. 4½ % First Pref.	100	3½	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5†	5†	37/32 — 39/32	..	5 13 6
Do. Def.	1	Nil	..	33/32 — 35/32	..	Nil
Do. 5 % Pref.	1	5	5	33/32 — 35/32	..	5 10 2
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½ —102½	..	4 17 7
Potteries, Ord.	1	2	..	33/32 — 35/32	..	..
Do. 5 % Pref.	1	5	5	33/32 — 35/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	⅜ — ½	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	2⅜ — 3	+ ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1⅛†	83 — 85	+5	..
Yorkshire (West Riding), Ord.	5	Nil	..	⅜ — ½	..	Nil
Do. 6 % Pref.	5	Nil	..	2⅞ — 3⅛	..	Nil
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5⅛	5 1/16 — 5 3/16	..	5 3 6
Do. 2nd Pref.	5	5	5⅛	4 15/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	102 —104	+ ½	4 6 7
Do. 5 % Deb.	100	5	5	103½ —105½	..	4 14 9
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10½ — 11½	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invs., Ord.	5	8	8†	9⅛ — 9	..	4 8 11
Do. 5 % Pref.	5	5	5	4¼ — 5½	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	134 —139	—1	5 15 1
Do. Pref. Ord.	100	6	6	118 —122	..	4 18 4
Do. 5 % Pref.	100	5	5	110 —113	+ ½	4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	+1	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104 xd	..	4 6 7
Calcutta Trams, Ord.	5	6	..	5 1/16 — 5 3/16	+ 1/16	5 1 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	90 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	9/32 — 3/32	..	..
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 5/16	..	4 6 0
Do. 4 % Deb.	100	5	5	101 —103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/32 — 9/32	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0

La Plata Elec. Trms, Ord.	1	..	..	25/32 — 27/32	..	..
Do. Pref.	1	6	6	15/16 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	100	5	5	95½ — 97½	..	5 2 7
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101½	..	4 18 6
Mexico Trams Com.	$100	7	7†	119 —121	+2	5 15 8
Do. Gen. Con. 5 % Bonds	..	5	5	97 — 99	+ ½	5 1 0
Do. 6 % Bonds	100	6	6	100½ —102½	+ ½	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10	6½ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 1/8	..	1 18 1
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	119½ —120½	+ ½	4 3 2
Do. 1st Mort. 5 % Bonds	..	5	5	102½ —103½	..	4 16 5
Do. 5 % Mort. Bonds	100	5	5	99½ —100½	+ ½	4 19 9
Sao Paulo Tram, Lt. and P.	$100	10	10†	198½ —200½ xd	..	4 19 9
Do. 5 % 1st Deb.	$500	5	5	104 —106	+2	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5½ — 5⅝	..	6 1 9
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103 —105 xd	..	4 5 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/32 — 5/32	..	..
Do. 6 % Pref.	1	9	6	29/32 — 31/32	..	7 2 2
Babcock & Wilcox	1	26	24†	6⅜ — 6⅝	— ⅛	8 15 7
Do. Pref.	1	6	6	13/16 — 15/16	..	3 13 10
B.I. & Helsby Cables	5	10	10†	6⅞ — 7⅛	..	6 17 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 13 9
British Westinghouse, Pref.	8	Nil	..	⅛ — 3/16	..	Nil
Do. Deb.	100	4	4	60 — 62	—1	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/32	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/32	..	Nil
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9½ — 10	+ ⅛	7 10 0
Do. Pref.	5	5	5	5 — 5½	..	4 15 3
Do. Deb.	100	4½	4½	98⅝ —100½	..	4 9 7
astner-Kellner	1	17½	20	3 3/16 — 3½	+ 1/16	5 9 11
Do. Deb.	100	4½	4½	105 —109	—1	4 10 7
Crompton & Co.	8	Nil	Nil	⅜ — ⅝	..	Nil
Do. Deb.	100	5	5	58 — 63	..	7 7 1

Dick, Kerr	1	5	..	27/32 — 31/32	..	5 3 1
Do. Pref.	1	6	6	1 5/16 — 1 3/32	..	5 9 9
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £8 paid	5	Nil	..	11/16 — 15/16	..	Nil
Do. fully paid	5	Nil	..	1 1/16 — 2 1/16	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	1/2 — 1	..	..
Do. Pref.	2	7	7	1⅜ — 1⅝	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 98	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9¼	..	5 5 3
Do. Deb.	100	4	4	87 — 92	..	4 7 0
Henley's, Ord.	5	15	10†	11¾ — 12½ xd	..	6 0 0
Do. Pref.	5	4½	4½	5 — 5½	..	4 5 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9½ — 10⅜	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	34 — 36 xd	..	6 7 0
Do. Deb.	100	4	4	99½ —101½	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 3/32	..	Nil
Do. Pref.	5	Nil	..	½ — 1½	— ⅛	Nil
Do. Deb.	100	4	4	61 — 64	..	6 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

ARTISTIC STREET LAMP STANDARDS.

[CONTRIBUTED.]

A BY no means unimportant factor in the fierce inter-city competition which has raged between various towns in North America during recent years has been the increasing attention paid to scientific and artistic street lighting—high illumination and attractive standards and fittings being both considered.

In the strenuous campaign for fresh citizens, as in the competition between different quarters of one town, it has been realised that brilliant street illumination from fixtures presenting a handsome appearance by day and by night is one of the easiest means whereby a town or a street may attract more attention than its neighbours. Once the pioneering difficulties were surmounted—and these, in such a matter, probably offer less obstruction in America than in any other country—progress was rapid. Where municipalities could not or cannot, for any reason, embark on a sufficiently ambitious scheme of electric street lighting there were formed, or are being formed, energetic committees of business men, all more or less interested in the proposals in hand, and all prepared to go to considerable personal expense and trouble to ensure their unqualified success. Such movements naturally receive hearty support from central station engineers, long-hour street lighting forming an admirable evening load.

FIG. 2.

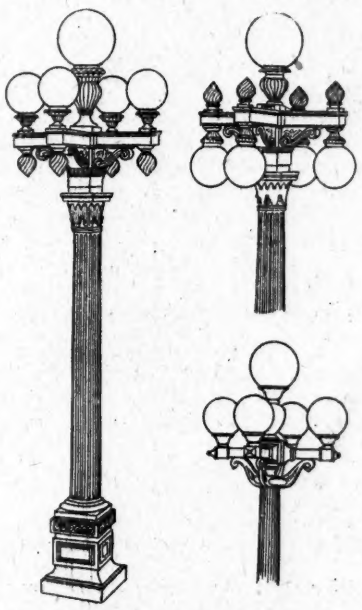


FIG. 1. FIG. 3.

Contrast these conditions and methods with the confirmed attitude of *laissez glisser*, or the spasmodic "ratepayers' agitation" (say, for six-flame arcs in a certain street), to be found in the majority of English towns, where street lighting matters are concerned, and it is not surprising to find that in the very materials employed we are much behind denizens of Canada and the States.

The drawn-tungsten filament lamp had been boomed, tested and discussed for months in America before it commenced to attract attention on this side, and, in the manufacturing and stocking of innumerable useful types of globes, reflectors and lamp fittings in general, we are undoubtedly behind America, though fully maintaining our position in Europe.

Confining our present attention mainly to the artistic appearance of a street lighting equipment, we find that one opalescent globe much resembles another; the globe supports or "lantern" framework lend a certain character to the equipment as a whole, but it is the bracket and standard which attaches an air of stability, dignity and beauty or of ugliness, insignificance or downright meanness to the entire installation. Prime cost is, of course, an important matter in determining the selection of a type of lamp standard, but therein can lay no adequate excuse for many of the hideous or merely unimaginative patterns adopted in the average English town. In view of the vast number of lamp and trolley poles now in use in this country, and bearing in mind the great effect, for good or evil, which these exert on the appearance of a town or street—and even in an "old" country the relative beauty of towns has appreciable effect on their prosperity and development, while the appearance of shopping quarters is of uncontrovertible importance—allowing for all these considerations, it certainly appears that insufficient attention has hitherto been paid to the design of street lighting and trolley poles in this country.

In the hope that wider attention will be called to the matter, the writer ventures to illustrate a number of novel designs which are striking and beautiful without being bizarre or excessively costly. Originality in English designs has been very largely confined to variations in the surface mouldings of the pedestals and shafts of poles, and to variations in the scroll work which, though mainly decorative, is often relied upon to strengthen considerably the main members. These improvements are, in most cases, excellent, but they are in matters of detail and, at a short distance, their individuality largely disappears. To show the intrinsic merits of entirely different styles of construction, to illustrate the general appearance of the poles as viewed from a short distance, and to omit those details of finish which can easily be varied to taste without appreciably affecting the general appearance of the structure, the poles illustrated herewith are shown for the most part in simple outline. After indicating their general construction, their technical merits from the illuminating standpoint will be briefly considered, and, in conclusion, will be presented typical data as to dimensions and costs.

Styles.—Standards modelled according to Corinthian designs have proved enormously popular in American cities. The great strength and beauty of this pattern is well illustrated by fig. 1—a five-globe standard patented by the Flour City Iron Works. By simply inverting the four lower lamp brackets, as shown in fig. 2, considerable change is effected in the general appearance of the standard, and the latter becomes, by its low-pendant globes and concentrated light distribution, more suitable for interior illumination than the pattern of fig. 1, which is specially adapted to street work. A plainer and lighter, but equally handsome, design, enabling the same lamp arrangement as shown in fig. 1, is provided by the standard illustrated in fig. 3. Following the same general design but employing bolder lines, a square shaft and inverted lower lamps, we arrive at the style shown in fig. 4, also much employed in America.

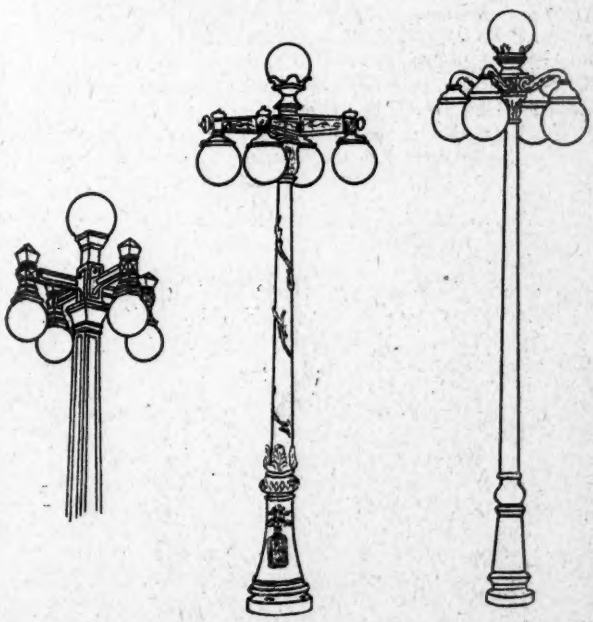


FIG. 4. FIG. 5. FIG. 6.

Fig. 5 represents a less rugged pole, otherwise similar to that illustrated in fig. 4, and one which presents a most

handsome appearance when lightly decorated as indicated (Cutter's patent). The design shown in fig. 6 sets the lower lamps considerably closer together, and, while increasing the obstruction, one globe with another, and yielding less widespread illumination than most of the preceding standards is, in the writer's opinion, of much less striking and pleasing design. However, *chacun à son gout!*—the result is still charming.

The highly ornamented, massive pillar illustrated in fig. 7 might, at first sight appear ungainly, but this, and even heavier patterns have proved very popular in high class

Fig. 7.

Fig. 8.

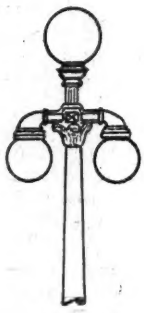


Fig. 9.

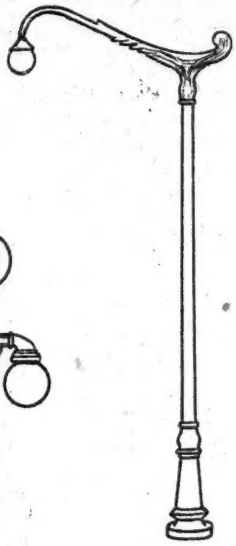


Fig. 10.

Fig. 13.

street lighting, and especially in illuminating entrances and frontages to which the pole design and finish is suited. (The particular standard illustrated is one of a number in use round the Gotham Hotel, New York).

Where only one lamp per standard is required, the design shown in fig. 8 is at once aesthetic and strong, but, by the injudicious addition of side globes (as in fig. 9), the whole effect may be destroyed. A single globe standard of rare beauty is shown in fig. 10. This pole is of great strength in those parts liable to mechanical damage, and, as compared with the type shown in fig. 8, it possesses the advantage of giving better illuminatiom immediately below the lamp, though, on the other hand, there will now be a certain shadow cast by the main column.

Turning to designs more nearly resembling those in use in the more fortunate of English towns, fig. 11 shows an elegant

Fig. 11.

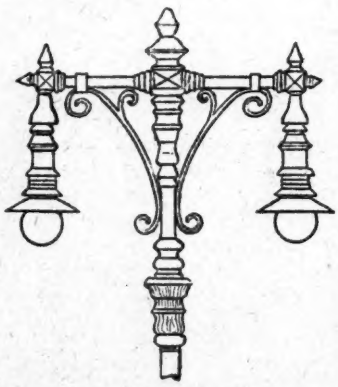


Fig. 12

pole-head equally suitable for arc lamps or metallic-filament lamp clusters. On bolder lines, fig. 12 represents a good design (Morris Iron Co.), and the three-globe standard shown in section in fig. 13 uses steel piping and sleeves, and is very light and strong while enabling excellent light distribution. The design is decorated and strengthened by scrolls of beaten ironwork in the angles in the ordinary manner.

A salient feature of the American designs illustrated is their "clean" build and highly artistic appearance, whether light or heavy, bold or smooth. Many less pleasing designs are, of course, in extensive use, and in a number of patterns we find an objectionable mixture of styles and over-ornamentation; it has naturally been the writer's aim to call attention to those forms most likely to find favour in this country, excluding all excessive styles.

Space forbids specific mention and illustration of the many combined traction and lighting, telegraph and lighting, or power transmission and lighting standards now on the American market. The best of these possess those artistic merits admired above, in addition to such constructional features as convenient bracket attachments, telescopic bracket arms (for use where outstanding lamps are to be kept collinear, though the standard columns be out of line), and so on. An exceptionally elaborate combined arc and incandescent lamp standard has recently been designed by the Buda-Pesth General Electric Co. for use in the streets of that city.

Where fire alarms, time switches, call boxes, and so on, have to be attached to street standards, we might with advantage imitate the practice of certain American manufacturers in opening out the main centre column, for a suitable distance, into a rectangular frame within which the required attachment is fixed without the unsightly and annoying projections otherwise unavoidable.

The Flour City Co., already noted, have co-operated with the Police and Fire Departments in a number of cities by equipping standards at various street crossings with "night signals." Red, violet or blue globes of the same external appearance as the iron "acorns" on the Corinthian pillars (figs. 1 and 2), are substituted for one of these parts on poles at the signal points, and incandescent lamps, for flash-signalling purposes from headquarters, are placed within these distinctive globes.

Illuminating Value.—The placing of individual lamps or clusters in three, five or more globes per standard, completely avoids the heavy shadow which would otherwise be cast by most of the pillars illustrated above. The longer the bracket arms, the more uniform the illumination obtained, and the less the mutual obstruction between globes. The "angle of obstruction" of the globe supporting caps varies from 50° to 80° in the types illustrated, but whatever shadow is cast by one bracket arm and globe cap is rendered quite unnoticeable by illumination from the remaining globes. The large opalescent globes usually employed, naturally result in a certain absorption loss, but this is fully compensated for by their handsome and attractive appearance by day, and by the equally beautiful "snowball" effect at night. Readers of the American electrical Press will remember a number of photographs showing the striking night appearance of "White Ways" illuminated on this system.

Three or five globe standards are usually placed 60—90 ft. apart along each side of the street, and, for combined beauty and efficiency, probably provide the cheapest street illumination yet evolved.

Materials, Dimensions, &c.—Cast-iron is naturally the usual material employed in the manufacture of these standards, but cast-steel or steel tubing is widely used where a slender design is desired, or where weight is a consideration. For specially high-class work and for standards to be used in shop or hotel frontage schemes, bronze is sometimes employed, but it may be doubted whether the additional cost is justified by the improved appearance attained.

With the class of standard illustrated in figs. 1—10 (usually carrying 1, 3, or 5 globes), 14 in. is a suitable diameter for the top globe, and 12 in. for the lower globes, if any, and whether upright or inverted. By this slight difference in diameters, the appearance of the completed standard is greatly improved. The angle subtended by the globe cap at the centre of the globe is usually between 50° and 60°, but occasionally rises to 70° or 90°; the lower range should be adhered to whenever possible.

At the ground line, the standard base is from 15 in. to 20 in. in diameter, and the height of the lower globe holder from ground level ranges from 10 to 12·5 ft. (figs. 1—10), up to 15—30 ft. (figs. 11—13). The "spread" of the bracket arms, from the centre of the main column to the centre of the lamp supports, varies from 1 ft. to 2 ft. in the types shown in figs. 1—10, and from 2·5 to 4·5 ft. in specially lofty single or double-bracket standards.

The weight and cost of the various styles illustrated depend essentially on the column diameter and on the degree of ornamentation employed. Single-globe standards, such as shown in fig. 4, may weigh from 250 to 450 lb. and cost from £2 15s. to £3 15s. apiece, while five-globe standards of similar style may weigh from 320 to 530 lb., and cost from £3 10s. to £4 10s. apiece. On the other hand, these figures may be doubled, or made yet greater, by the adoption of heavier columns and brackets, and more elaborate ornamentation. Standards such as shown in figs. 11 and 12 may weigh 1,000—1,500 lb. and cost £15—£20 each.

It need hardly be mentioned that in American, as in home designs, absurdly large structures often carry a ludicrously small lighting equipment. Thus a certain large maker provides a standard, 14 ft. from ground to bracket (16 ft. overall), 15 in. in base diameter, and with a 5-ft. bracket to carry—a single incandescent lamp! In all such cases, a simple span-wire with a self-levelling hanging lantern had better be employed. Span arches present a better appearance, but are very liable—as in the case of the Forth Bridge—to require an enormous amount of metal to carry their own weight.

An apology can hardly be needed for these notes. The matter with which they deal concerns every citizen, and certainly there is an ample field in this country for the application of the principles, methods and apparatus described.

VOLUME CHANGES IN ACCUMULATOR ELECTRODES.

By C. TOONE.

One of the most familiar phenomena of lead accumulators is the growth of the positive and the shrinking of the negative electrode, and it is a very common belief that the positive plate expands solely during charging and particularly during over-charging. This, however, occurs only during the first charging, the so-called "forming," when metallic lead or lead oxide is converted to lead-peroxide (the highest known oxide of lead) a change which is accompanied by an increase in weight and volume. On discharge, lead sulphate is formed on both plates, with an increase in weight and volume of the latter. If both electrodes were initially of the same paste, say, red lead, spread on precisely similar grids, they would initially have exactly equal porosities; but, during formation, the positive plate would become denser by the absorption of oxygen and the negative plate would become more porous, by the liberation of oxygen. For this reason, all changes during charge and discharge occur more readily and with less loss in the negative than in the positive plate. For some time past, accumulator manufacturers have realised the importance of securing maximum porosity in

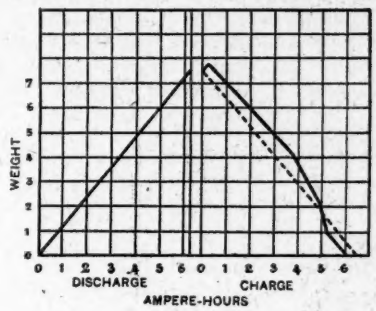


Fig. 1.

their plates and have prepared positives and negatives by different processes, each suited to the working conditions to be met; the positives with large active surfaces and the negatives with much spongy lead.

Schoop, in his work "Ein Beitrag zur Kenntnis der Diffusionvorgänge an Akkumulatorenelektroden," has described a means whereby the weight changes in accumulator plates on charge and discharge may be studied directly by the aid of a balance. Theoretically, 3·85 gm. of spongy lead on the negative plate is converted to 5·64 gm. of lead sulphate per ampere-hour, and, in the positive plate, 4·44 gm. of lead peroxide yields 5·64 gm. of lead sulphate; fig. 1, shows the increase and decrease in weight of a spongy lead plate on discharge and charge respectively (as determined by Schoop's method). During discharge the weight increases practically

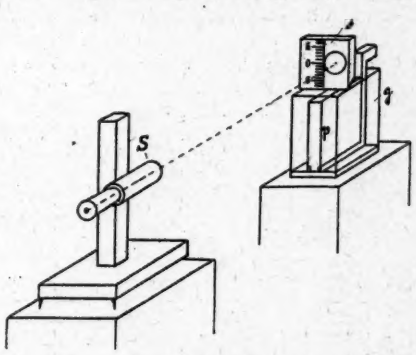


Fig. 2.

linearly with the ampere-hours, but, during charging, the curve shows a marked deviation due to the collection of hydrogen bubbles in the pores of the spongy lead.

H. Hobel, writing in the *Elektrotechnischer Anzeiger*, describes an adaptation of the Poggendorf-Gauss mirror method to the direct observation of the working changes in volume of accumulator plates by determining their change in height. The spongy plate *p* (fig. 3) consisted of a pasted block 84 mm. high, 60 mm. wide and 8 mm. thick; the hard lead rim was removed from one side and the top edge to permit free expansion of the spongy material. The electrode was fixed to the base of the containing vessel *g* by sealing wax, and its upper edge was provided with the glass cone *k* bearing on the block attached to the back of the mirror *s* (fig. 2). The lower edge of the actual mirror block *s*, being chamfered and resting on the edge of the containing vessel, acts as the fulcrum about which the rise and fall of *k* tilts the moving system.

The spongy plate stands between two lead sheets (not shown), which act as positive electrodes, but on which no measurements are required. The complete cell stands on a rigid masonry column, and a cathetometer S is mounted on a neighbouring rigid foundation; the arm of action of the cone *k* being very small, and the distance from *s* to S being 2 or 3 metres, there is no difficulty in securing a magnification of 1,000, *i.e.*, in accurately observing 1 mm. displace-

ment of s in the telescope—corresponding to $\frac{1}{1000}$ mm. movement of k. In fig. 4 the scale displacements are taken as directly proportional to the plate movement, and from the conditions of the measurement, it will be seen that the error in the assumption is small.

Referring to fig. 4, curve a shows the increase in electrode height during a discharge at 1·18 amps. for 7·5 hours. The scale deflection at the end of this period (11·0 mm.) increased to 12 mm. during a rest period of 15·5 hours

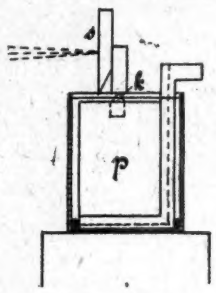


Fig. 3.

(dotted curve). After this, a further discharge period of one hour at 1·18 amperes increased the scale deflection to 15 mm. During charging (curve b and lower time scale), for 9·25 hours at 1·18 amperes, the decrease in height followed the solid curve b, while, during the dotted rest-period, the total decrease attained 22 mm. below the starting zero-line. It is clear that during the discharging and charging cycle, the negative plate has undergone a permanent change (a shrinkage), otherwise the curve b would close on the beginning of a, and, charge and discharge being followed by no structural alteration—within the limits of elasticity—the plate would be of practically constant capacity for a very long time in service. Unfortunately, in pasted plates of the above description, the shrinkage cannot be prevented. The above method affords a very rapid and sufficiently accurate examination of the shrinkage characteristics of

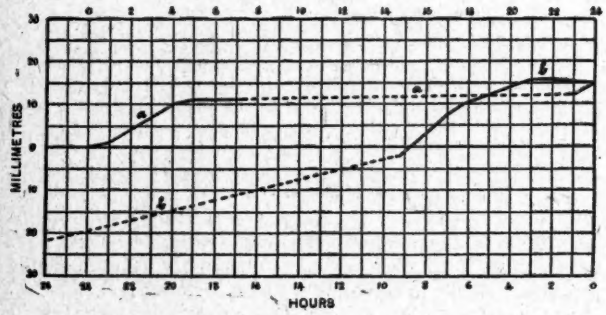


Fig. 4.

any new pasting mixture and is, of course, at once applicable to any type of plate, positive or negative. The apparently paradoxical rise of the curve b over a during the first hours of the charge is due to the rising temperature of the cell, and such secondary action can easily be avoided by maintaining the test-cell at constant temperature.

The mirror method is applicable to the comparison of pasting and "forming" methods, and appears to be quite suitable for the rapid testing of new types of accumulators. The present tests applied to the latter are both tedious and costly and, if carried out at exceptionally high currents, in order to save time, the results obtained cannot safely be taken as indicative of the actual service performance of the cells; but according as the volume changes of the electrodes of a cell, determined as above, show a tendency, during several successive charges and discharges, to become constant or continue varying, the degree to which the capacity of the cell may be expected to decay in service can be accurately prophesied.

TRADE STATISTICS OF BRITISH INDIA.

The following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1911, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1910, are added for purposes of comparison, and notes of any increases or decreases are given :—

15 rupees = £1.

	1909-10. Rupees.	1910-11. Rupees.	Increase or decrease. Rupees.
Lampware.—			
From Great Britain ...	9.10.000	10.49.000	+ 1.39.000
„ Germany	5.84.000	8.80.000	+ 2.96.000
„ Austria	5.34.000	6.59.000	+ 1.25.000
„ United States ...	5.79.000	5.60.000	— 19.000
„ Other countries ...	1.70.000	2.55.000	+ 85.000
Total ...	27.77.000	34.03.000	+ 6.26.000
Other hardware, except enamelled ware.—			
From Great Britain ...	1.26.61.000	1.31.69.000	+ 5.08.000
„ Germany	23.74.000	30.81.000	+ 7.07.000
„ Belgium	8.99.000	14.85.000	+ 5.86.000
„ Austria	2.79.000	3.94.000	+ 1.15.000
„ United States ...	7.85.000	10.42.000	+ 2.57.000
„ Other countries ...	6.82.000	10.74.000	+ 3.92.000
Total ...	1.76.80.000	2.02.45.000	+25.65.000
Brass, wrought.—			
From Great Britain ...	5.41.000	5.80.000	+ 39.000
„ Germany	49.000	66.000	+ 17.000
„ Austria	48.000	1.01.000	+ 53.000
„ Other countries ...	2.95.000	3.02.000	+ 7.000
Total ...	9.33.000	10.49.000	+ 1.16.000
Copper and copper ware.—			
From Great Britain ...	1.49.82.000	2.07.90.000	+58.08.000
„ Germany	59.82.000	75.57.000	+15.75.000
„ Belgium	19.78.000	35.65.000	+15.87.000
„ Italy	3.64.000	4.59.000	+ 95.000
„ Austria	1.77.000	2.82.000	+ 1.05.000
„ Japan	28.40.000	42.83.000	+14.43.000
„ Other countries ...	1.12.000	1.60.000	+ 48.000
Total ...	2.64.35.000	3.70.96.000	+1.06.61.000
Iron wire.—			
From Great Britain ...	95.000	1.41.000	+ 46.000
„ Germany	13.000	7.000	— 6.000
„ Belgium	3.12.000	4.94.000	+ 1.82.000
„ Other countries ...	1.52.000	2.06.000	+ 54.000
Total ...	5.72.000	8.48.000	+ 2.76.000
Steel plates and sheets.—			
From Great Britain ...	76.71.000	93.85.000	+17.14.000
„ Germany	18.18.000	11.30.000	— 6.88.000
„ Belgium	25.28.000	23.93.000	— 1.35.000
„ Other countries ...	57.000	55.000	— 2.000
Total ...	1.20.74.000	1.29.63.000	+ 8.89.000
Steam engines (except locomotives).—			
From Great Britain ...	73.45.000	69.66.000	— 3.79.000
„ Belgium	36.000	2.21.000	+ 1.85.000
„ United States ...	1.75.000	2.28.000	+ 53.000
„ Other countries ...	1.15.000	1.57.000	+ 42.000
Total ...	76.71.000	75.72.000	— 99,000
Electrical machinery.—			
From Great Britain ...	26.57.000	26.64.000	+ 7.000
„ Germany	27.000	3.24.000	+ 2.97.000
„ Belgium	49.000	5.11.000	+ 4.62.000
„ Italy	1.99.000	1.82.000	— 17.000
„ United States ...	2.28.000	2.34.000	+ 6.000
„ Other countries ...	15.000	44.000	+ 29.000
Total ...	31.75.000	39.59.000	+ 7.84.000
Mining machinery.—			
From Great Britain ...	4.81.000	7.20.000	+ 2.39.000
„ Germany	—	3.000	+ 3.000
„ United States ...	2.19.000	6.42.000	+ 4.23.000
„ Other countries ...	37.000	18.000	— 19.000
Total ...	7.37.000	13.83.000	+ 6.46.000
Machinery, other (except textile and agricultural).—			
From Great Britain ...	1.51.00.000	1.39.83.000	—11.17.000
„ Germany	4.87.000	8.78.000	+ 3.91.000
„ Belgium	2.29.000	7.36.000	+ 5.07.000
„ United States ...	8.69.000	14.71.000	+ 6.02.000
„ Other countries ...	2.30.000	2.17.000	— 13.000
Total ...	1,69,15.000	1,72.85.000	+ 3.70.000

	1909-10. Rupees.	1910-11. Rupees.	Increase or decrease. Rupees.
Railway carriages, &c.—			
From Great Britain ...	2.28.46.000	1.45.38.000	—83.08.000
„ Belgium	94.000	4.52.000	+ 3.58.000
„ Other countries ...	44.000	46.000	+ 2.000
Total ...	2.29.84.000	1.50.36.000	—79.48.000
Locomotives and tenders, and parts thereof.—			
From Great Britain ...	87.06.000	73.52.000	—13.54.000
„ Germany	13.000	48.000	+ 35.000
„ Other countries ...	62.000	—	— 62.000
Total ...	87.81.000	74.00.000	—13.81.000
Rails and fishplates.—			
From Great Britain ...	88.86.000	72.61.000	—16.25.000
„ Belgium	2.68.000	1.38.000	— 1.30.000
„ Other countries ...	3.93.000	—	— 3.93.000
Total ...	95.47.000	73.99.000	—21.48.000
Glass lampware.—			
From Great Britain ...	1.38.000	1.33.000	— 5.000
„ Germany	3.25.000	4.49.000	+ 1.24.000
„ Austria	2.75.000	4.10.000	+ 1.35.000
„ Other countries ...	1.34.000	2.32.000	+ 98.000
Total ...	8.72.000	12.24.000	+ 3.52.000
Electrical instruments, apparatus, &c.—			
From Great Britain ...	39.40.000	43.99.000	+ 4.59.000
„ Germany	1.80.000	3.74.000	+ 1.94.000
„ Belgium	49.000	1.87.000	+ 1.38.000
„ Austria	10.000	76.000	+ 66.000
„ United States ...	1.29.000	66.000	— 63.000
„ Other countries ...	39.000	49.000	+ 10.000
Total ...	43.47.000	51.51.000	+ 8.04.000
Scientific, &c., instruments.—			
From Great Britain ...	12.15.000	13.48.000	+ 1.33.000
„ Germany	74.000	74.000	—
„ Belgium	32.000	84.000	+ 52.000
„ United States ...	40.000	38.000	— 2.000
„ Other countries ...	50.000	55.000	+ 5.000
Total ...	14.11.000	15.99.000	+ 1.88.000
Telegraph construction materials.—			
From Great Britain ...	1.20.000	32.000	— 88.000

In addition to the foregoing, the following were imported as Government stores :—

	1909-10. Rupees.	1910-11. Rupees.	Increase or decrease. Rupees.
Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	15.47.000	13.80.000	— 1.67.000
„ Germany	4.000	1.000	— 3.000
„ United States ...	72.000	1.000	— 71.000
„ Other countries ...	6.000	4.000	— 2.000
Total ...	16.29.000	13.86.000	— 2.43.000
Machinery.—			
From Great Britain ...	27.53.000	24.81.000	— 2.72.000
„ Germany	2.000	6.000	+ 4.000
„ United States ...	14.000	1.000	— 13.000
„ Other countries ...	4.000	1.000	— 3.000
Total ...	27.73.000	24.89.000	— 2.84.000
Iron wire.—			
From Great Britain ...	1.56.000	3.54.000	+ 1.98.000
Steel plates and sheets.—			
From Great Britain ...	6.67.000	6.35.000	— 32.000
„ United States ...	1.000	—	— 1.000
Total ...	6.68.000	6.35.000	— 33.000
Railway carriages.—			
From Great Britain ...	96.77.000	49.22.000	—47.55.000
„ Other countries ...	1.56.000	69.000	— 87.000
Total ...	98.33.000	49.91.000	—48.42.000
Locomotives.—			
From Great Britain ...	87.56.000	48.40.000	—39.16.000
Rails and fishplates.—			
From Great Britain ...	59.83.000	67.68.000	+ 7.85.000
„ Belgium	—	11.000	+ 11.000
Total ...	59.83.000	67.79.000	+ 7.96.000
Telegraph construction materials.—			
From Great Britain ...	6.28.000	10.56.000	+ 1.28.000
„ Belgium	3.000	—	— 3.000
„ United States ...	13.000	—	— 13.000
„ Other countries ...	9.000	4.000	— 5.000
Total ...	9.53.000	10.60.000	+ 1.07.000

PROCEEDINGS OF INSTITUTIONS.

Peat as Engine Fuel.

By T. TOMLINSON, B.A.I., M.I.E.E., M.I.C.E.I.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Dublin, March 14th*, 1912).

THIS paper is a continuation of two previous papers in which the author has dealt with the subject of peat.

In 1907 two things were doubtful: (1) Could peat in Ireland be used on a practical scale for the production of power? (2) Could peat be got in Ireland at a price allowing of its use for power production with electrical distribution commercially on a very large scale?

At this date the first has been decisively settled in the affirmative by power undertakings on a large scale—as we shall see later; the second is not settled, nor is it likely to be settled till a determined effort is made to do so.

The present state of the problem may be concisely stated thus :—The problem is solved as to the economical generation of power from peat, it is not solved as to the getting of peat in Ireland continuously in large quantities and at such a definite known and low price as to make the success of a large enterprise certain.

It will, doubtless, be news to most that there is one instance of complete success on an enormously large scale, depending on no elaborate machinery and on no fancy patents, but simply upon sane engineering continuously and purposefully applied, much as the author pleaded for in his paper before the Institution of Civil Engineers of Ireland.

The author came upon the record of the success in an old book, and as the facts are unknown to most people, the author proposes to give a summary with a running commentary :—

The author, Mr. M'Meadows, had partly originated, and had been a member of a then recent Irish Peat Fuel Commission which had carried out certain investigations upon the Continent, and in this pamphlet he gives his own conclusions.

Evidently the main work of the Commission was the examination of the claims of certain then new methods of machine treating peat for the production of dense peat fuel.

The author goes on to demonstrate (1) that only the top layers of the deep Irish bogs require machine treatment; (2) that machine-made peat costs more than hand-cut peat; (3) that the Dutch had, by hand labour, transformed whole provinces from barren bogland into valuable agricultural land teeming with plenty, and this at a time when English and German coal was cheaper in Amsterdam and Rotterdam than in Dublin, Cork, or Limerick.

His general conclusion is best given in his own words :—"It is most wise and proper to mature the best mechanical arrangements for making dense turf out of fibrous peat; but, at the same time, most unwise and improper to neglect the utilisation of the large resources, in the shape of comparatively unfibrous peat, that are open to us at once, and which, instead of steam engines and macerating mills, require only the strong arms and tough-handled slanes of good Irish turf cutters, for yielding supplies of excellent fuel."

The fact that only a small proportion of a deep Irish bog needs any treatment other than drainage to make excellent fuel has been and is still too often overlooked. Our author is emphatic on this point :—"In almost all our bogs we have facilities for drainage, which are entirely wanting in those peat districts of Holland, in which the peat has to be dredged up from under water. To subject such black peat as is capable of being drained in Irish bogs, to any mixing or tearing process, would be simply a waste of time and money."

The fact that hand-getting is cheaper than machine-getting is as true now as it was 36 years ago. All the supposed improvements in peat-getting have not altered this fact. The very figures which the author gave in 1873—6s. for hand-getting and 8s. to 9s. for machine-getting per anhydrous ton—are those deduced by me from the figures given by Mr. Nystrom's Report to the Canadian Government in 1908. If these two facts had been borne in mind, most of the failures, which have brought projects of peat utilisation into well-deserved disrepute, would have been avoided.

The most interesting and suggestive part of the pamphlet is that in which the author—to enforce his contention as to the feasibility of a hand-worked peat industry with reclamation—instances its success in Holland and the Netherlands.

The work apparently began about 1628, when desolate, marshy districts were disposed of in lots to colonists by whom the winning of the peat and the reclamation of the land was begun. In spite of obstacles and temporary suspensions, the work went on, in stolid Dutch fashion, and so successfully that, about 1700, a Dutch

colony offered to colonise the Bog of Allen and to turn it into a meadow.

The working of the peat fields in the Netherlands, regarded as a principal of industrial and agricultural wealth, has created entire provinces; it has supplied, and still supplies, employment for the needy classes, and it has transformed houseless wanderers into owners of the soil. We thus see what the Netherlands owe to peat.

During the period in which the use of turf so largely increased in the Netherlands, the price of coal did not average more than 25s. per ton at any of the Dutch ports.

The use of the peat for power-production on the bog is a commercial possibility now, as it was not in 1873, and its utilisation in this way has two very important advantages over its use as fuel off the bog:—(1) The peat so used need not have the water reduced below 60 per cent.; (2) the recovery of sulphate of ammonia in the process of gasifying the peat is commercially profitable under favourable conditions.

The importance of the first point is that the difficulty of extracting water from peat and the time taken to do it increases very rapidly as the proportion of water to peat decreases, so that the possibility of using it with so high a percentage of water decreases the cost of production and makes possible continuity of supply without expensive storage and double handling.

The importance of the second point is that, under favourable conditions, the cost of the fuel would be covered by the value of the sulphate of ammonia.

Very favourable conditions would be a demand for power of 2,000 H.P. or over, worked day or night, a high percentage of nitrogen in the peat, a total cost of peat of 4s. or less per anhydrous ton, with a certainty of continuous production.

The first and most obvious improvement is thorough drainage; the effect of this upon reducing the labour cost per ton of anhydrous peat is shown by the following figures:—

"In a bog newly drained, 15 cb. yards contain 1 ton of anhydrous peat." "One year drained, 12 cb. yards contain 1 ton of anhydrous peat." "Two years drained, 9 cb. yards contain 1 ton of anhydrous peat."

Here is a possible saving in labour of getting of 40 per cent. by drainage.

The cost of the surface drainage is very high. A very much cheaper and more effective method of realising the saving in labour due to drainage before cutting would be thorough bottom drainage of a portion of the bog cut off from the main bog, with local surface drainage of the cut-off part.

That bog, thoroughly surface and bottom drained, will continually lose water at first by drainage, and then by evaporation and capillary attraction, is obvious.

Relying on drainage and evaporation, with protection from rain, I believe it to be certainly possible (1) to improve enormously the existing hand-cut peat industry; (2) to provide continuously and at low cost, fuel for industrial purposes.

A very simple experiment, and a very cheap one if made on a suitable bog, would establish the facts that the bulk of the water can be got rid of, slowly, it is true, but inexpensively; that the best peat, now unworked, can be made available; and that the land ultimately reclaimed is much more valuable for agricultural purposes than the undrained cut-away bog as left under the present conditions of working.

The owner of a large bog area—and there are many such—might consider the following figures:—Say the bog has an area of 1,000 acres and an average depth of 20 ft. The present value of such a bog will be £2,000 to £5,000 if a purchaser can be found. The actual contents of the bog in anhydrous peat is about 2,400,000 tons, or, allowing one-fourth to be left as soil for the unclaimed area, say 1,800,000 tons (anhydrous), available as fuel. This is certainly worth at least 3d. per ton royalty for electro-chemical power purposes if it can be shown that peat with 50 per cent. water can be got standing on the bog for 2s. per anhydrous ton. This amounts to £22,500, and the reclaimed land will be worth at least £10,000, or a total value of £32,500, say £30,000. The value of the peat as fuel is about £180,000. The gross value of the sulphate of ammonia is about £660,000, the net value about £330,000. The fuel would supply 2,000 H.P. day and night for 140 years.

Let me give a quotation from Mr. Nystrom's Report to the Canadian Government, "Peat and Lignite," 1908:—"In Holland the bogs are very expensive. A bog, 6 to 7 ft. deep, sells for $486 (£97) per acre.

Remembering that in Ireland a bog, 20 to 30 ft. deep, sells for £2 to £5 per acre, there was evidently sound commercial sense in that offer of the Dutch to colonise the Bog of Allen.

The essential difference between the Dutch success and the Irish failure is that the Dutch cut out the whole bog and so got both the fuel value and the reclaimed land value, while the Irish simply cut off the top peat of little fuel value and then reclaimed the top surface of the waterlogged underlying peat of great fuel and little agricultural value.

The peat belt of Ireland—as to six-sevenths of the total area of peat deposit—lies "between a line drawn from Wicklow Head to Galway and another drawn from Howth Head to Sligo." The area of peat land is one-seventh of that of Ireland, equal to 3,000,000 acres, or 4,600 sq. miles. There is no part of Ireland which is beyond reach of power derived from this area.

It is not necessary to insist upon the vast economic difference to Ireland between supplying the power, light, and to a steadily increasing extent the heat required, from her own peat resources, with recovery of agricultural land, as against the supply of these demands by means of imported coal.

Every country with large peat areas but Ireland has a special department to deal with its utilisation; here, unfortunately, the matter is left to private initiative, and capital has been frightened away by failure after failure.

In face of an honest and alert public department such exploitations of the credulity of the investing public would be impossible.

It may be worth while, before leaving this part of the paper, to make an estimate of the value of the bogs. These cover one-seventh of the area of Ireland, and extend over 4,600 sq. miles, or 3,000,000 acres. If we assume them to be on the average of the same value as the Dutch bogs, 6 ft. deep, as before given, namely, £100 per acre, we have a total value of £300,000,000.

As a matter of fact, I estimate the gross value of the peat and bog products and reclaimed land as £1,200,000,000.

The value to the country politically of the solution of the problem of bog utilisation, in the increase of employment, in the increased industry, and, above all, in the calling of the city slum-dwellers back to countryside, is not measurable in cash terms.

So much for the peat winning side of the problem. Now as to its application when won. Here we are on sure ground. (Then follows a report of a test of peat gas plant lately put down at Portadown, as recently published in the ELECTRICAL REVIEW.)

This installation proves, on the facts given, that peat can be substituted for anthracite at 32s. 6d. per ton under favourable conditions as to proximity to the bog, good weather, and small demand, with a decided saving.

The cost of peat, 6s. per ton, with 20 per cent. moisture, *i.e.*, 7s. 6d. per ton anhydrous is too high for the wide scheme of utilisation I am advocating as possible, and shows that this—the most important side of the problem—has been quite untouched and still lies open for solution.

The Power Gas Corporation claim to have developed a means of mechanically drying peat from 80 per cent. moisture to 50 per cent. moisture, independent of the weather conditions, at a total cost, including excavating, manufacturing, drying and all handling, of about 3s. per anhydrous ton.

The ideal to be aimed at, in my opinion, is 10,000 tons of peat (reckoned on its anhydrous contents) standing dried *in situ* on the bog, 10,000 tons less dry but drying, and the certainty of this supply being available year after year—coupled with such improvements in the producers as shall allow of the use of the peat in big amorphous lumps, not neatly-cut sods, so that the peat could be rather quarried than cut, and transported direct to the producers—with, say, 1,000 tons under cover for emergencies.

It may appear that this is a rather large order. As a matter of fact, based on the recorded price per cubic yard of excavating the narrow intensive drains with the Dolberg Dowbrowsky cutter (6d. per cubic yard) the labour cost of the drains (18,000 cubic yards) would be only £450, and would be offset by the value of the 1,350 tons of anhydrous peat cut in the process, as well as the 30,000 tons exposed to intensive drainage and air drying *in situ*.

On a suitable bog I estimate that the first 30,000 tons would cost £2,000 to £3,000, and it would be about five years before the first 10,000 tons were available *in situ*—thereafter an increasing annual supply would be available at a gradually decreasing cost as the bog dried out and electric power became available. I should expect in the long run to get the peat at the producers at 2s. per anhydrous ton.

Flashing-over in Commutator Machines.

By W. W. FRITH, M.Sc.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Newcastle, March 11th*, 1912.)

BY the term flashing-over is meant the formation of an arc with explosive violence between the brushes of a commutator machine subjected to abnormal conditions of load. In every case the flash-over appears to be associated with high current density in the brushes and excessive sparking. The arc forms a low-resistance path between the brushes, and the machine is virtually short-circuited as long as the arc exists. The arc is carried away from the commutator surface chiefly by the magnetic action of the leakage flux, and is finally broken at the outer portions of the brush-gear. In motor or converter cases, however, the circuit-breaker may operate, and the arc is then extinguished by the withdrawal of the power.

Of all machines, the converter is most subject to flashing-over, the usual cause being a short-circuit on the direct-current side. It also occurs frequently in motors subjected to excessive overloads or to accidental breaking of the field circuit; it seldom occurs in generators, probably for the reason that armature reaction on short-circuit greatly reduces the voltage across the segments.

In multipolar machines the flash sometimes extends around the circumference of the commutator, but as a rule is confined to certain pairs of brushes, a reason for which is suggested later. Flashing-over is a source or considerable anxiety to engineers because of the danger to attendants and the damage which usually results to the machine itself. A brush-gear is generally badly damaged, and often the machine is put out of commission for repair. A remarkable feature of the phenomenon is that the commutator is seldom, if ever, in the slightest degree injured, in spite of the fact that the flash starts at its surface.

A valuable clue to the cause of flashing-over is afforded by a fact previously mentioned, that it is always associated with heavy initial sparking at the brushes. This may occur at any load, and depends upon the setting of the brushes; a machine set to run sparklessly at full load will probably not flash-over at full load, but will do so on light load if a short-circuit develops in either case.

There are only two possible reasons for an arc forming between

the brushes; either an abnormal rise of voltage or a decrease of resistance; the former is very unlikely to happen, and there is left only the second alternative, namely, the establishment of a conducting path between the brushes. The path may consist (*a*) of carbon particles liberated from the brushes by excessive sparking or (*b*) of a series of local arcs across the segments.

It is likely that both agencies are concerned—imperfect commutation as a primary cause and carbon dust as a secondary one; probably the function of the dust is to reduce the resistance of the arcs over the mica insulation. That carbon dust has some influence in producing flash-over is supported by observations on a 7½-H.P. 430-volt Westinghouse motor loaded with a direct-coupled

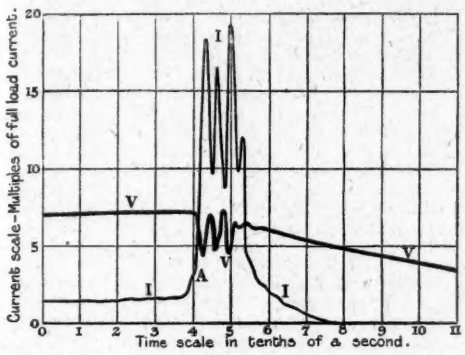


Fig. 1.

100-volt 50-ampere generator. Flash-over could be produced when desired by short-circuiting the fully-loaded generator through a 40-ampere fuse. The flash was always present at the upper surface of the commutator where the carbon dust is held on by gravity, but none was observed on the lower surface, where the carbon dust can fall clear. Further evidence is that when the commutator and brushes had been well cleaned, flashing-over could not be produced until the machine had run for some time afterwards.

Fig. 1 is a copy of a photographic record of current and voltage to the motor at the time of flash-over, from which it is quite clear that the flash is not started by a voltage rise, and is therefore due to the second cause—viz., a fall of resistance across the surface of the commutator. The establishment of such a conducting path between terminals across which a voltage of 480 is maintained is quite sufficient to start a current which instantaneously develops into a short-circuit. The arc is then blown out by the leakage

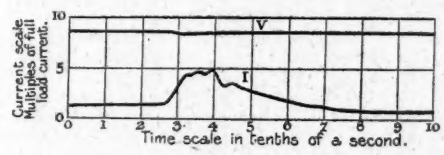


Fig. 2.

flux, but another one is at once started unless the short-circuit has cleared; a succession of flashes occurs so long as the short-circuit lasts.

In the voltage record of fig. 1 there are large fluctuations below the normal voltage terminated by a falling line as the machine comes to rest, the main fuse of the motor having blown during the short-circuit.

A distinct change in the slope of the current curve will be noticed at A, which point probably represents the instant of flash-over; it is of importance to the theory of progressive short-circuit to note that the time measured on the oscillogram from the bottom bend up to A closely corresponds with that required for a segment to move from one brush to the next.

Until the fuse blows, the arc is maintained by the supply mains, and afterwards by the energy stored in the revolving armatures. The maximum current recorded on fig. 1 is 19 times full-load current, and the energy absorbed is about 7,500 ft.-lb.; the total time of flash-over measured on fig. 1 is 0·4 second. The ripples in both voltage and current appear to be due to the varying length of the arc as it passes over the irregularities of brush-gear and horns.

The real solution of the problem of flashing-over is in the design of machines with good commutation, and with an ample allowance of insulation between the segments, in machines which are subject to the trouble.

A most effective preventive of flashing-over has been found by the author in the use of asbestos-faced wipers placed between the brushes and extending the full length of the commutator. With these wipers in position it was found to be impossible to produce a flash-over under the most extreme conditions of load and sparking. On short-circuiting the loaded generator a shower of flashes starting from the brush-tip, travelled over the surface of the commutator to the wipers, where they were instantly quenched. Fig. 2 is an oscillogram taken under these conditions, from which it will be seen that the maximum current reached is about five times that at full load.

A further advantage in the use of the wipers is that the surface of the commutator is kept quite clean and normal sparking reduced to a minimum. The only drawback to their use is that they retain the carbon dust, and after a time become dirty. This results in some slight sparking under the wipers, particularly if set, as in this experiment, in the central position where the segments are carrying their maximum voltage. This points to the advantage of using thin wipers set close to the trailing tips of the brushes, and arranging them so that they may be easily cleaned or renewed.

The arrangement now used is to make the brush box double, the second compartment carrying the wiper. On the heaviest short-circuit, sparking is confined to the narrow space between the brush and the wiper.

Discussion.

Dr. W. M. Thornton said that at one time he had held the theory that flashing-over was due to a rise in voltage, but Mr. Firth had clearly shown that the true cause was the maintenance of a true arc between the segments, and this result was contributed to by the disintegration of the brushes due to the initial sparking.

Prof. Robertson, Bristol (communicated) did not think that disintegration of the brushes was at all necessary in order to produce flashing-over, as the small arcs drawn out between the segments and the brushes were sufficient in themselves.

Mr. G. Stoney said that flashing-over was liable to occur in a machine in which the voltage per segment was high and where the pole-tips were of the wrong design. It could be reduced by the use of compensating windings and the other devices which were employed to improve the sparking constants. The use of thicker mica between the segments had also a beneficial effect. He had found that turbine machines fitted with carbon brushes were less liable to give trouble, as were also two-pole machines as compared with four-pole ones. Wipers had been tried 10 or 12 years ago and abandoned, and he did not think that they were practicable in commercial work.

Mr. W. Baxter agreed that the leakage flux had a good deal to do with carrying the arc away from the commutator, and also in finally extinguishing it altogether. He thought that the fact that generators were generally designed with better sparking constants than were motors was the true explanation of the lesser liability of the former to flashing-over. He could not agree that any one pair of brushes were more liable to go over than any other pair; and with regard to the suggestion that the particles were held on the top surface by gravity, he pointed out that in the machine tested the centrifugal force was 193 times the force of gravity, so that the difference between the top and bottom sides was only about 1 per cent. He thought that the best plan was to design machines which would stand 100 per cent. overload without sparking, and in any case it would be difficult to sell machines fitted with wipers.

Mr. J. Schuil said that the whole question resolved itself into one of obtaining sparkless commutation. Some Brown-Boveri machines for 1,750 volts D.C. with 52 volts between segments worked perfectly, simply because perfect commutation was provided for. The reason why a commutating pole machine cleared itself after a flash-over was that the inter-poles automatically provided a stronger reversing field in that event.

Mr. Burgess said that the wipers were sure to give trouble when they became dirty, and he could hardly imagine these on, say, a 600-volt traction motor. The solution did not lie in the use of wipers, but in the correct design of the machine for its work. He thought that it should be possible to utilise condensers to take up any spark which might occur.

Mr. Firth, in reply, did not think that the centrifugal force would be so great as had been stated, because it was not at all certain that the particles were travelling at the same speed as the commutator. He could not see why wipers should not be used commercially; they were cheap, easily renewed, and did not add appreciably to the cost of the machine.

The Röntgen Society.

The meeting of the Röntgen Society on March 5th was held, by special invitation of Prof. Silvanus Thompson, at the City and Guilds Technical College, Finsbury, where the members had an opportunity of putting to a personal test the discovery of Prof. Thompson that an alternating magnetic field produces certain physiological effects, chiefly visual. Prof. Thompson said that he was induced to take up the subject on reading in Lord Kelvin's papers that some years ago Lord Lindsay, now the Earl of Crawford, had constructed a large electro-magnet capable of producing a powerful magnetic field, but that on placing his head between the poles of the magnet no effect whatever was observed. Thereupon the speaker caused to be manufactured two large copper coils, each of them weighing rather more than a hundredweight, and containing 10,000 magnetic lines per square centimetre. It was arranged to have one of these at each side of the head and to excite them by means of an alternating current generated on the spot. The effect was to produce a certain flicker, colourless, or of a slight bluish tint—other speakers subsequently described it as golden yellow—not well defined over the whole region of vision, and rather brighter at the periphery than in the centre. The effect was best seen in the dark, but the flicker persisted in the ordinarily lighted room, and seemed to superimpose itself over the visible objects. The effect differed in intensity according to the direction in which the head was placed between the coils. It was greater if the coils were at the temples than if the magnetic influence had to pass from the front to the back of the head. The only other effects produced were some nausea and vertigo after a long continued

experience, and, in some cases, a slight taste in the teeth. It was possible that the nerves of hearing were stimulated equally with the nerves of sight, but if this were so the noise in the generating room "drowned out" any such subjective effect. Two people among the large number who had made the experiment were unable to see anything unusual. In a *résumé* of the work, most of it negative, previously done upon this subject, Prof. Thompson referred to a statement by Prof. Birkeland that the workmen engaged in the nitrate works at Notodden, Norway, were able to see lights at night over some of their magnetic machinery, and also to some similar statements of psychologists in this country. It might be that "sensitives" were able in the dark to see flames standing above permanent magnets, but he pointed out that so far as his own investigations were concerned, the effect was bound up with the alternating current, and nothing unusual was observed at all with the continuous steady current. In a verbal communication to the Société de Biologie, of Paris, D'Arsonval stated that an intense magnetic field—110 volts, 30 amperes, 42 periods per second—gave rise when the head was plunged into it to "phosphenes" or appearances of light in the eye. In Prof. Thompson's opinion the effect was due to electric currents induced by magnetism, and existed in proportion to the degree of magnetism produced.

The Electric Driving of Rolling Mills.

A special meeting of the Newcastle Local Section of the Institution of Electrical Engineers was held at Darlington on February 26th. The works of the Darlington Forge Co. was visited, as was also the Municipal electricity works, where the members were entertained to tea by the Corporation.

In the evening the paper on "The Electric Driving of Rolling Mills,"* by Mr. C. A. Ablett, was read by Mr. L. Rothera, in the absence of the author, and the following discussion took place:—

Mr. G. Stoney said that their unavoidable time-lag seemed to be the drawback of all automatic regulators. He did not think that three or four mills would be sufficient to equalise the load on a central station, as on a tramway system, with 50 or 60 cars running, variations up to 200 per cent. above normal were observed.

Dr. W. M. Thornton thought that the moving parts of automatic regulators were usually made too heavy. Even if they were perfectly balanced, it was still necessary to put the parts into motion, and this occupied an appreciable time. With regard to rope losses, he thought that with 10 per cent. as given in the paper, it would be difficult to keep the ropes from charring.

Mr. A. H. Marshall regretted that everyday figures for the consumption in units per ton rolled had not been given for the sake of comparison with direct driving by steam. In the Middlesbrough district there were seven electrically-driven mills of over 1,000 h.p., all supplied by the local Electric Supply Co., with 2,750 volts 40 cycles three-phase current, and, so far as he knew, there had been only one instance of trouble of an electrical character, and even that was not serious. The costs given in the paper for a supply under the maximum-demand system were rather misleading, as instantaneous peaks were not recorded by the demand meters, the usual basis being a half-hour one.

Mr. J. Ingham did not agree with the figures given in the paper for rope losses. With a well-designed drive, the loss should not exceed 2½—3 per cent. He agreed that the rope loss remained constant for wide variations of the power transmitted, and consequently it was important that the ropes should be worked at or near full load. His own practice was to design the ropes for 80 to 90 per cent. of the normal power of the motor. Taking the case of a 500-h.p. motor, he would use 12 2-in. ropes running at 3,200 ft. per min., giving a loss of 3½ per cent. at full load and 5·3 per cent. at average load. The life of the ropes would be about two years, working 120 hours per week. Assuming 60-ft. centres, the ropes would cost about £10 each, and the total annual cost for renewals would be £60. Comparing this with a similar drive but with 16 ropes, which would probably last three years, the extra cost was only £7 per annum. Against this there would be an increase in efficiency equal to 9·6 h.p., which, at ·3d. per h.p.-hour, would effect a saving of £75 per annum, thus showing a net saving of £68 due to using the smaller number of ropes.

Mr. Rothera (in reply) said that he thought that it would be false economy to install ropes capable of transmitting only 80 per cent. of the normal power of the motor, and as peaks equal to twice the normal would have to be dealt with frequently, he did not think that the ropes would last very long. The efficiency of the Ilgner system varied from 60 to 70 per cent., but the increased output more than compensated for this somewhat low figure. When they saw steam-driven mills with as many as 10 sets of gear wheels, it was obvious that an enormous amount of power was being wasted, and anything which would eliminate this waste would be an advantage.

A Dutch Electrical Exhibition.—The Maatschappy van Nyverheid, or Dutch Industrial Union, intend to hold an Electrical Exhibition from June 3rd to 23rd next in the rooms of the Zoological Garden at the Hague. The object is the popularising of electric appliances and processes. Engineer J. C. Boot, Frederik Hendrik-laan 12, The Hague, is the Secretary.—*Elek. u. Maschinenbau.*

* For abstract, see Electrical Review, February 9th, 1912.

PARLIAMENTARY.

London Electric Railways Bill.

Last week a Select Committee, under the chairmanship of Sir Luke White, considered this Bill, which proposes to authorise the company to construct a railway joining up with the present authorised extension of the Baker Street and Waterloo line to Paddington on to Queen's Park, Willesden, where a junction will be made with the London and North-Western Railway line. It also provides for the construction of a moving staircase at Oxford Circus Station and subways at Southwark. It also amalgamates with the company the Edgware and Hampstead Railway Co., which has powers to construct a railway from Golder's Green to Edgware. The Bill also contained powers for the London and North-Western Railway Co. to raise £1,000,000 for the various works set out; for the London Electric Railway Co. to raise £750,000 4 per cent. preference stock, and for the company to supply electricity to the North London Railway Co. and to the Richmond Electric Supply Co.

Mr. J. D. Fitzgerald, K.C., opened the case for the promoters, and said the principal object was to enable a new line to be made from Paddington to Queen's Park, which would mean running through a thickly populated district not at present provided with direct railway communication to the centre of London. At Queen's Park the new line would form a junction with the London and North-Western Railway's line to Watford, which was now in course of being electrified, and the result would be that passengers would be able to travel direct from Watford to the Elephant and Castle. So convinced were the London and North-Western Railway of the success of the proposal, that they were willing to advance £1,000,000 for the construction and equipment of the new line. A further object was the amalgamation of the Edgware and Hampstead Railway with the company. This company obtained powers in 1902 to construct a line from Golder's Green to Edgware, but owing to the promoters being unable to raise the necessary capital it had not been constructed. It would, however, be a valuable extension for the London Electric Railway Co., and they and the Underground Co. would find the necessary capital.

Mr. Stanley, managing director of the company, gave formal evidence. The estimated cost of constructing and equipping the line from Paddington to Queen's Park was £918,600.

The only petitions against the Bill were those of the Westminster City Council and the London County Council, and as the objections were not pressed the Committee passed the preamble of the Bill.

Brighton Tramway Proposals.

On Thursday, February 14th, a Select Committee of the House of Lords, presided over by Lord Newton, commenced the consideration of the group of Bills being promoted for tramway powers in Brighton and District. The first Bill taken was that of the Brighton Corporation. Mr. H. Lloyd, K.C., Mr. G. J. Talbot, and Mr. Clode appeared for the Brighton Corporation; Mr. Balfour Browne, K.C., Mr. J. W. Fitzgerald, K.C., and Mr. Tyldesley Jones for the Hove Corporation; Mr. Freeman, K.C., for the East and West Sussex County Councils; Mr. C. C. Hutchinson and Mr. Lyndon Macassey for the British Electric Traction Co., and there were several local authorities and gas companies also represented.

Mr. H. Lloyd, K.C., in opening the case for the Brighton Corporation, said the proposal was to install a trackless trolley system of tramways on various roads within the borough, and also in Hove and the districts of Portslade, Southwick, and Shoreham. The Hove Corporation were promoting a Bill to run a similar service in Hove, Portslade, Southwick, and Shoreham, and the British Electric Traction Co. proposed to resuscitate the tramway which at present existed in Hove and in the districts West of Hove. Practically the proposal of the Brighton Corporation was to install a through east and west route from the eastern boundary, through Hove to the districts beyond. The Brighton Corporation were an existing tramway authority, but so far they had never seen fit to put down tramways near the sea front for the reason that they considered the roads unsuitable, although there could be little doubt that such a service would prove far more lucrative than the existing routes. For the past few years, however, the Corporation had been attracted with the idea of a railless system along this route, although it was true that now there was a derelict tramway along part of the proposed route, and also a service of motor-'buses. The existing tramways in Hove were authorised in 1888, and they had fallen into the hands of the British Electric Traction Co. In 1903 the company were authorised to extend the line to Worthing, but nothing had been done in the matter. Then, as the result of action taken by the Hove Corporation to deal with the tramway, the company in 1910 brought forward a Bill to extend the tramways at either end, so as to go to Worthing and Brighton, but owing to opposition of all the three Corporations affected, it fell through. Last year the Brighton and Hove Omnibus Co. promoted a Bill for trackless tramways, but all the power they got was to install a system from Brighton to Rottingdean. The Omnibus Co. had promoted a Bill this year, but the Brighton Corporation had come to terms with the promoters. The effect of the provisional agreement was that if the present Bill of the Brighton Corporation were carried, the Omnibus Co. would transfer to the Corporation the powers they obtained last session for a cash payment. With regard to Hove, if the Hove Corporation really wanted a trackless trolley system, he would undertake to construct the portion of the system within

Brighton, and leave it to the Hove Corporation to construct the portion within Hove. What it came to was, that if it was agreed that such a system was desirable, there would be no difficulty about Brighton and Hove each respectively taking their powers and finally regulating how these things should be constructed. As to the opposition of the Tramway Co., he contended that it was merely an attempt to try and resuscitate a tramway which was derelict, and he submitted that it was against the public interests that this should be allowed. He understood that the local authorities were desirous of better facilities, but they held the view that only one system should be allowed. In regard to the Gas Co.'s opposition, he would not trouble the Committee with the clause giving the Brighton Corporation power to supply electricity in outside districts by consent, and would say at once that all Brighton now asked for was power to supply the electric energy required for running the proposed service of trolley vehicles.

Mr. Alderman Geere, Deputy Mayor of Brighton, was called, and bore out counsel's opening statement. A deputation from the Corporation had visited Leeds and Bradford to inspect the railless system there. The Omnibus Co. had both petrol and electric 'buses, and the effect of the agreement provisionally entered into was that the Corporation would acquire the electric 'buses and the charging stations and leave the company with the petrol 'buses.

Cross-examined by Mr. Balfour Browne, Witness admitted that the Corporation last year opposed the Bill of the Omnibus Co., which contained practically similar proposals to those in the present Bill; but their reason for doing it was because the Corporation were the tramway authority. He admitted that they had received a letter from the Board of Trade, pointing out that some of the roads were too narrow for the proposed system, but they did not intend to widen them.

Questioned by Mr. Hutchinson, Witness said the intention was to do away with the present tramways owned by counsel's clients, but they were not asking for that power in the present Bill.

Witness was examined at great length by other petitioners regarding the question of depreciation of property, &c.

Alderman F. T. Wilson (chairman of the Brighton Corporation Tramways Committee) also gave evidence, and pointed out that at present the existing tramways were handicapped by having to serve only hilly routes; but in spite of this, since 1903-4 the tramways had, with small exceptions, paid their way. He understood that the expense of running the trackless system would be less than that of running 'buses. He saw no reason to object to the overhead equipment, because the route to be served was chiefly through commercial streets.

After further local evidence had been given,

Mr. J. B. Hamilton, general manager of the Leeds City Tramways, gave evidence, and said he considered Brighton a suitable town for a trackless trolley system. There was no reason why a trackless trolley vehicle could not pass with absolute safety wherever a motor-'bus went, because it would be about 6 in. narrower than the 'bus. A trolley vehicle would also be a ton or 30 cwt. lighter than an electric motor-'bus. He had gone into the figures in the estimates and considered they would show a profit.

On cross-examination, Witness admitted that the Leeds system was an extension from the centre to the outside districts. Exclusive of overhead equipment, the cost of working trolley vehicles was 6d. to 6½d. a mile, but he was not aware that the cost of motor-'buses was not more than 7·7d. Motor-'buses carried 34 passengers, and the proposed trolley vehicles 28, but he did not know whether that number would be final. He did not know any place where double-decked cars were worked on the trolley system, but he considered it a perfectly safe proposition. He did not agree that the system was at present in an experimental stage, although it was in a stage of evolution.

(To be continued.)

Edgware and Hampstead Railway Bill.—This Bill came before Sir Luke White's Select Committee last week, the object being to allow of a deviation of the authorised line at Hendon and to give an extension of time for completion. The only opposition was that of Sir J. Blundell Maple's Trustees with regard to the acquisition of some land at Burnt Oak, and the Committee found the preamble proved.

Southall, Hounslow and Twickenham Railless Traction Bill.—It is reported that the petition for this Bill has been withdrawn. It will be remembered that the promoters failed to satisfy the Examiner that Standing Orders had been complied with.

Annual Dinner.—Electrical Installations, Ltd., held their Fifth Annual Staff Dinner on 9th inst., at the Crown and Cushion, London Wall, E.C., when some 60 members of the staff were present, with Mr. H. F. Simon, manager of the company, in the chair. Mr. Simon, in his speech, alluded to the very satisfactory progress which the company had made in the past year, and with a view to showing the management's appreciation of the staff's valuable services, presented, on behalf of the directors, a donation to the recently founded "Electrical Installations, Ltd., Athletic Club," which, in the first season of its existence, had done so well in the football field as to reach the final tie for the "Davis" Football Challenge Cup, open to teams of firms in the electrical industries. After the dinner a smoking concert was held, various musical items being contributed by members of the staff.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

BRAZIL.—The new Brazilian Budget recently introduced provides, amongst other things, for the following new rates of duty :—

Manufactures of cast-iron or steel not specially mentioned in the Customs Tariff, enamelled...	1,200 reis per kg.
Electrodes, electric machines, electric turbines, electric furnaces, put together or not; iron plates coated with tin or lead, necessary for the installation and working of manufactories of carbide of calcium established in Brazil ...	8 % ad val.

It is also laid down that all machinery and material destined for the first public installation of light, power, water supply, drainage, and imported directly by States and Municipalities, excluding that destined for private houses, are to be dutiable at the rate of 8 per cent. *ad valorem*. The same duty is to be levied on screws, rivets, tubes of copper or glass, and other articles, even if they are separately specified in the Tariff, which are imported with machines adapted thereto, and in quantities strictly necessary for the working of the same.

The undermentioned articles, when imported by "railway companies and by manufactories of china, fine stoneware, porcelain, or vitrified tiles for pavements," are to be allowed the following special rates :—

Physical apparatus, and articles or instruments adapted for electrical power and light installations...	8 % ad val.

N.B.—35 per cent. of the amount of duty is leviable in gold at the rate of 1,000 reis = 2s. 3d.; the remainder in currency at 1,000 reis = 1s. 3½d.

A surtax of 2 per cent. of the duty is also levied.

The Budget Law also provided that Consular invoices for shipments of merchandise to Brazil shall be presented in triplicate to the Brazilian Consul or Consular Agent, who, after authenticating them, shall send the original direct, together with the ship's papers, to the Custom house of the port or place of destination. (Hitherto, the original has been handed by the Consul to the shipper to be forwarded to the consignee for presentation to the Customs on clearance of the goods.) The two copies of the invoice are to be exempt from stamp duty. The value of the goods for Customs clearance is to be based on the original invoice as transmitted to Brazil by a Consul of that country.

In case the examination of the goods in Brazil shows that divergences exist between the Consular invoice and the contents of the packages, the owner or consignee of the goods shall be liable to a fine of twice the amount of the duties (whatever such amount may be) arising through the difference in question, whether resulting from a difference in quality, quantity, weight, lower rate of duty, or value. The declaration in the invoice of the gross weight of the merchandise, when it is subject to payment of duty on the net weight, or *vice versa*, shall be included amongst the divergences giving rise to the penalty mentioned above.

These new Consular invoices are to come into force on April 1st.

ROUMANIA.—A bill has recently been laid before the Chamber by the Roumanian Government which proposes to modify the existing Roumanian Customs tariff. The following proposed alterations will be of interest to readers of the Electrical Review :—

	Present duty.	Proposed new duty.
	Lei per 100 kg.	
Copper wire less than 1 mm. thick	30	20
Cables for the transmission of electric current, and insulated wire for electrical conduits—		
(*a*) With covering or casing of sheet iron, iron wire or iron bands	12	6
(*b*) Without metallic casing, but insulated with paper, asbestos, or other materials, not specially mentioned	20	10
(*c*) Insulated with india-rubber or gutta-percha	30	15
(*d*) Insulated with textile thread other than silk, even combined with other materials	50	25
(*e*) Insulated with silk thread	100	50

It is also proposed that parts and accessories of machines and apparatus specified in Nos. 735 to 744 (*i.e.* all machines *except* electrical) imported separately or as reserve pieces, are to be dutiable as wares of which they are made. Machines specified in Nos. 735, 736, 740, 744 and 745 (*i.e.* engines, machine tools, printing machines, machines and apparatus not specially mentioned, dynamo electric machinery, electric motors, converters, transformers and distributors) if imported by the Ministry of Public Works, by the Railway Administration and by State industrial establishments for their own needs shall be exempt from import duty with the authorisation of the Ministry of Finance, and in so far as they are not manufactured in the country.

NORWAY.—Wireless telegraphic apparatus being widely installed on Norwegian shipping, the Government have issued an order declaring all such apparatus duty free until further notice.—*Elek. u. Maschinenbau.*

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,415. "Metal-vapour alternating-current rectifiers and similar apparatus." Hartmann & Braun Akt.-Ges. (Convention date, March 2nd, 1911, Germany.) March 4th. (Complete.)

5,416. "Electrolysis of metal solutions." F. Hodgson. March 4th.

5,432. "Method of automatically igniting gas lamps and the like." E. W. Ashton and T. M. Spurge. March 4th.

5,434. "Apparatus for charging accumulators." K. von Dreger. (Convention date, March 3rd, 1911, Germany.) March 4th. (Complete.)

5,446. "Brush-holders for magneto-machines for electric ignition." A. G. Bloxam (firm of R. Bosch, Germany.) March 4th. (Complete.)

5,447. "Speed control of direct-current motors." Siemens-Schuckertwerke G.m.b.H. (Convention date, March 6th, 1911, Germany.) March 4th. (Complete.)

5,462. "Electrical tumbler switches and the like." A. Wynne. March 5th.

5,467. "Electric lamps, electroliers, and the like." Peyton & Peyton, Ltd., and H. B. Bond. March 5th.

5,469. "Trolley collectors for electrically-driven tramway cars or road motor vehicles." E. P. B. Estler. March 5th.

5,534. "Electric signal or indicator for taximeter cabs or other similar public vehicles." P. T. Hillman. March 5th. (Complete.)

5,542. "Automatic mechanism for operating electric switches, valves, and the like." R. C. Griesbach and Venner Time Switches, Ltd. March 5th.

5,544. "Electrically-driven planing machines and similar reciprocating tools." Vickers, Ltd., and A. D. Williamson. March 5th.

5,545. "Process of manufacturing negative electrodes for alkaline accumulators." Svenska Ackumulator Aktiebolaget Jungner. (Convention date, March 7th, 1911, Sweden.) March 5th. (Complete.)

5,551. "Generation of alternating currents." K. Zickler and R. Czepek. (Convention date, March 19th, 1911, Austria.) March 5th. (Complete.)

5,554. "Apparatus for connecting conducting wires, cables, and the like." A. Fodor. March 5th. (Complete.)

5,559. "Electric block-signalling systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 5th. (Complete.)

5,560. "Holders for electric lamps." C. C. Regnart. March 5th.

5,562. "Electrical switches." S. L. Price. March 5th.

5,575. "Couplings for electric conductors." British Thomson-Houston Co., Ltd., H. N. Sporborg and A. S. Cubitt. March 5th.

5,576. "Electro-magnetically-operated switches." British Thomson-Houston Co., Ltd., and E. Garton. March 5th.

5,584. "Wireless telegraphy." C. H. Gulliver. March 5th.

5,590. "Telegraph and like cable conductors." W. E. Hitch. March 6th.

5,629. "Magnetos used with internal-combustion engines." E. E. Bentall and G. C. Bingham. March 6th.

5,630. "Electrical resistances." Electrical Apparatus Co., Ltd., and G. Farquhar. March 6th.

5,635. "Process for treating water or other liquids by means of ultra-violet rays produced in a quartz lamp and apparatus therefor." C. Knips. (Convention date, March 6th, 1911, Germany.) March 6th. (Complete.)

5,636. "Device for attaching overhead line wires to insulators." G. K. Paton. March 6th.

5,651. "Calculating typewriting and other machines." E. C. R. Marks (McCaskey Electric Calculator Co.) (Divided application on 9,563/1911, April 19th.) March 6th. (Complete.)

5,655. "Telegraph systems." H. H. Harrison, G. W. Moore and J. Savin. March 6th.

5,692. "Electrical engine or machinery tell-tale." J. C. Clarke and Chadburn (Ship) Telegrph Co., Ltd. March 6th.

5,703. "Switch-throwing mechanism for electric railways and the like." R. V. Collins. (Convention date, November 10th, 1911, United States.) (Complete.)

5,717. "Electro-magnetic apparatus for automatically discharging liquids from vessels in which the pressure can be either above or below the atmosphere." C. D. Burton and Garner, Telford & Hardman, Ltd. March 7th.

5,719. "Automatic switch and relay." E. F. Kent. March 7th.

5,720. "Application of electricity to a lock designed for giving an alarm signal and the application of an insulating material to a key for the said lock." E. E. Alexander. (J. H. Preston, Canada.) March 7th.

5,723. "Means for transforming electrical energy into heat energy particularly applicable to hair-drying apparatus." London Electrical Trading Co., Ltd., and C. O. Bastian. March 7th.

5,741. "Electric bell switches." A. B. Ebbs. March 7th.

5,774. "Production of luminous radium effects." Gebr. Junghans Akt.-Ges. (Convention date, February 15th, 1912, Germany.) March 7th. (Complete.)

5,775. "Method of mounting and driving dynamos on railway and similar vehicles." Electric and Ordnance Accessories Co., Ltd., and J. Etchells. March 7th.

5,796. "Electric relays." E. Möller. (Convention date, March 8th, 1911, Sweden.) March 7th. (Complete.)

5,803. "Electric motor-control systems." Allgemeine Elektricitats Ges. (Convention date, March 7th, 1911, Germany.) March 7th. (Complete.)

5,810. "Combination of an electric switch and fuse." A. H. Mayes. March 7th.

5,814. "Switch arrangement for pocket, torch, cycle, hand and motor lamps." J. F. Smith. March 8th.

5,850. "Mechanical and electrical machine for a train to put to danger its signal after passing it." W. G. Mellor. March 8th.

5,853. "Bath for the electrolysis of iron." G. Tischenko. March 8th. (Complete.)

5,854. "Electrolysis of iron." G. Tischenko. March 8th. (Complete.)

5,855. "Process and apparatus for the electrolytic refining of ores." G. Tischenko. March 8th. (Complete.)

5,856. "Electrical insulating means." H. W. Turner. March 8th.

5,862. "Electric switches." British Thomson-Houston Co., Ltd., and E. B. Wedmore. March 8th.

5,871. "Power producing apparatus." F. V. W. Swanton. March 8th.

5,876. "Telephone exchange systems." P. Jensen (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911. April 12th.) March 8th. (Complete.)

5,877. "Telephone exchange systems." P. Jensen. (Clement International Engineering Corporation, United States.) (Divided application on 9,142, 1911, April 12th.) March 8th. (Complete.)

5,887. "Supports for lamps." E. I. Parkes. March 8th.

5,888. "Construction of branched electric fittings." E. I. Parkes. March 8th.

5,889. "Control device for electrically-operated hot-air douches." E. I. Parkes. March 8th.

5,902. "Apparatus for electrically-indicating the available seating accommodation in theatres, halls or other public places." Tyler Apparatus Co., Ltd. March 8th.

5,904. "Apparatus for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., J. E. Cochrane and R. D. Bargay. March 8th.

5,907. "Conductors or lugs for electric conductors." J. E. M. Ross and J. Shaw.

5,919. "Means of making contact of operating electric signals for use principally in mines." M. Fryar. March 9th.

5,924. "Apparatus for transmitting orders or the like, indications specially applicable for ships' telegraphing apparatus." P. R. Keppie and H. M. R. Maddick. March 9th.

5,962. "Apparatus for electric welding of tubes." Ges. fur Elektro-technische Industrie m.b.H. (Convention date, March 9th, 1911, Germany.) March 9th. (Complete.)

5,971. "Speed control circuits for series-wound motors for cranes and the like." Siemens Schuckertwerke G.m.b.H. (Convention date, March 10th, 1911, Germany.) March 9th. (Complete.)

5,972. "Telephone metering systems." A. J. Boult. (International Telechronometer Co., United States.) March 9th. (Complete.)

5,985. "Time-controlled mechanism for electric switches." R. Haddan. (Copeman Electric Stove Co., United States.) (Divided application 22,001, 1911, October 5th.) March 9th. (Complete.)

5,986. "Electrically-heated ovens." R. Haddon. (Copeman Electric Stove Co., United States.) (Divided application on 22,001, 1911, October 5th.) March 9th. (Complete.)

5,987. "Controlling means for electric cooking apparatus." H. Haddan. (Copeman Electric Stove Co., United States.) (Divided application on 22,001, 1911, October 5th.) March 9th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electromagnetic Device. B. Soldatencow. 14,658. June 17th. (January 11th, 1911.)

1911.

Lighting and Regulating of Electric Arc Lamps. Harlé et Cie. 25,182. November 4th. (November 12th, 1910.)

Electrically Actuated and Controlled Apparatus for Operating Railway Semaphore Signals. O'Donnell and British Pneumatic Railway Signal Co. 25,345. February 4th. (Divided application on No. 2,887 of 1911. February 4th.)

Electric Ignition Devices for Internal-Combustion Engines. Firm of Robert Bosch. 29,868. December 30th. (February 18th, 1911.)

Electrical Heating Apparatus. A. F. Berry. 1,074. January 14th.

Electric Controllers for Lifts and the like. Easton Lift Co. and W. J. Huggett. 3,268. February 8th.

Underground Electric Cable Troughing. O. V. Thomas. 3,446. February 10th.

Electric Incandescence Lamps. E. G. Royer. 3,541. February 11th. (February 12th, 1910.)

Push-Button Circuits for Electric Controllers. T. Barnard and C. Edwards. 4,191. February 18th.

Electromagnetically Controlled Perforating Mechanism. M. Kotyra. 4,498. February 22nd.

Holders for Electric Lamps. G. H. Cottam. 5,594. March 6th.

Spark Generator for Wireless Telegraphy. S. Walker. 7,582. March 27th.

Storage Battery Plates. H. Lake. (United States Light and Heating Co.) 8,421. April 8th.

Apparatus for Sterilising Liquids by the Action of the Ultra-Violet Rays. T. Nogier. 9,660. April 20th. (December 22nd, 1910. Patent of Addition not granted.)

Electric Jacquard Apparatus. A. Regal. 10,363. April 28th. (May 17th, 1910.)

Electrically Insulated Fish-Joints for Railway Rails. W. R. Sykes Interlocking Signal Co. and G. H. Sykes. 11,711. May 15th.

Regeneration of the Hitherto Waste Products of Galvanic Cells or Batteries. Chemische Fabrik Griesheim Elektron. 12,040. May 18th. (June 3rd, 1910.)

Automatic Starting Devices for Electric Motors. H. J. Haddan. (Whittingham.) 12,587. May 24th.

Metallic Armouring for Insulated Electric Cables. A. H. Howard. 13,760. June 9th.

Electric Arc Lamps for Cinematograph Projection and the like. A. Cole and F. Wilson. 15,794. July 7th.

Electric Incandescent Lamp. O. Schaller. 16,195. July 13th. (July 13th, 1910.)

Speed Regulation of Dynamo-Electric Machinery. H. Pieper. 17,675. August 3rd. (August 6th, 1910.)

Methods and Apparatus for Shaping Filaments for Electric Lamps and the like. R. W. Suman. 19,047. August 24th. (May 31st, 1911.)

Single-Phase Commutator Motors. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 20,829. September 20th.

Sparking-Plugs for Internal-Combustion Engines. The Firm of Robert Bosch. 20,899. September 21st. (December 3rd, 1910.)

Electric Searchlights. L. Pasqualini. 22,429. October 11th.

Common-Battery Telephone Systems. Aktiebolaget L. M. Ericsson & Co. 23,823. October 27th. (November 9th, 1910. Addition to No. 21,924 of 1911.)

Attachment or Device for use in Connection with Telephones. H. S. Bryant and Third Hand Patents, Ltd. 23,987. October 28th.

Cables for Electric Current Distributing Systems. C. H. Merz and R. V. Hunter. 26,857. November 30th. (Divided application on No. 4,004 of 1911. February 16th.)

Long Non-Stop Diesel Engine Test.—It is reported that Messrs. Barclay, Curle & Co., of Glasgow, who are building a sister ship to the *Selandia*, described in our issue of March 8th, have recently completed a 30-day non-stop (night and day) full-load trial of one of the 1,500-H.P. eight-cylinder Diesel engines for their vessel. The machinery ran without hitch, and was in perfect condition when opened up. This is said to be the longest reliability trial of Diesel plant on record. Scotch shale oil fuel was used, the consumption averaging 35 lb. per I.H.P.-hour (according to report).